NORTH AMERICAN

SKYLINE

VOL. THREE
NUMBER ONE

January, 1942

KANSAS CITY PLANT
DEDICATION NUMBER

AMERICA GEARS FOR WAR! A nation of free men, dedicated to peaceful progress, now creates the Arsenal for Democracy and builds in abundance the weapons for its own defense. Teamwork is the key to this great effort as factories, forges and shops throughout the nation have been geared to the mass production of parts, materials and sub-assemblies for North American military airplanes, turned out in ever greater volume at Inglewood, Calif., Dallas and soon at Kansas City.
KANSAS CITY
DALLAS
INGLEWOOD
★ TO BUILD WITH TEAMWORK IS the North American Way
N A A

North American Skyline

Reg. U. S. Patent Office

JANUARY, 1942

Volume Three **Number One**

Reply to a Challenge

This edition of SKYLINE *commemorates an event which recent world happenings have invested with vastly greater import than it originally possessed—the start of production in the great bomber assembly plant being operated by North American at Kansas City for the United States government.*

North American enters this new phase of the emergency fully prepared, both in spirit and productive facilities, not only to meet whatever demands may be made of its far-flung organization, but also to take the initiative in enthusiastically putting forth that extra instalment of energy which comes only of the unswerving will to win.

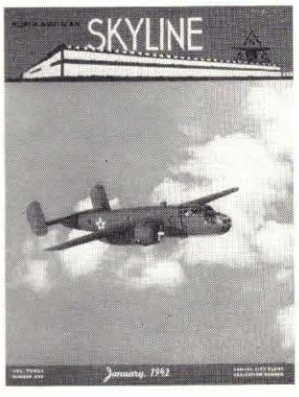
The thousands of "men behind the men with wings" in North American's plants ceased on December 7 to work for wages alone, or even for the joy of a job well done. Spontaneously, they consecrated the skill of hand and brain to the successful culmination of the greatest crusade of all time.

This surge of energy was not simply a matter of intangibles; it came to light in numerous hastily-drawn posters, the more expressive because of indifferent artistry, and in slogans chalked on machines. More important, it appeared in the guise of a sharp upward angle on the production charts.

There came to the man in the shop, as to millions of other Americans, the conviction that the hour for unhesitant sacrifice in a cause touching his own security was at hand. His answer is being spoken in the language he knows best.

The Cover

A frequent sight, and a reassuring one these days, is that of armed American aircraft cruising overhead. Among these warplanes, the North American B-25 medium bomber occupies an eminent position, having proved time and again by its speed and maneuverability that it has the stuff of which champions are made. Since this issue of* Skyline *is dedicated to North American's new bomber assembly plant at Kansas City, Kansas, it is fitting that the cover should feature a picture of the B-25. In the words of Lieut. General Henry H. Arnold, Deputy Chief of Staff, United States Army, " . . . this hard-hitting member of our striking power is one of the speediest bombers in the world, with a speed approaching that of the standard fighter planes in use abroad." The advertisement on the back cover, captioned "Another North American First," tells in brief the inspiring story of North American's new Kansas City unit. The inside back cover is a photomontage of production scenes within the Inglewood plant.



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Training PILOTS and Combat CREWS

Written for Skyline
By Brigadier General George E. Stratemeyer
Chief of Training Division, United States Army Air Corps

THAT Uncle Sam really means business in this matter of building the world's strongest air force is shown by the War Department announcement on October 23 that the U. S. Army Air Forces would be expanded from its present goal of 54 combat units (not yet fully in effect) to 84 groups, with a total of some 400,000 in personnel by the end of June, 1942. Since the entrance of the United States into the war this program is being considerably augmented.

Behind this simple announcement lies a tremendous program involving the production of airplanes, the selection and training of men, and the establishment of the necessary air bases and ground facilities. In this article I shall deal particularly with the second of these three air force fundamentals, the training of pilots and combat crews.

OFFICIAL PHOTOGRAPH, U. S. ARMY AIR CORPS

Brigadier General Stratemeyer

Fortunately, this tremendous training program is already fairly well advanced, and the achievement to date is little short of a miracle. Starting from scratch in 1938-39, when the Air Corps was turning out about 300 flying officers per year from two flight training schools, the rate was stepped up to 7,000 per year during 1940. To reach this greatly accelerated output, nine civilian training schools were chosen, and a primary flight training course of standardized instruction, based on Air Corps experience and practice, was set up. That left the Air Corps free to concentrate on the basic and advanced training in its own flying schools.

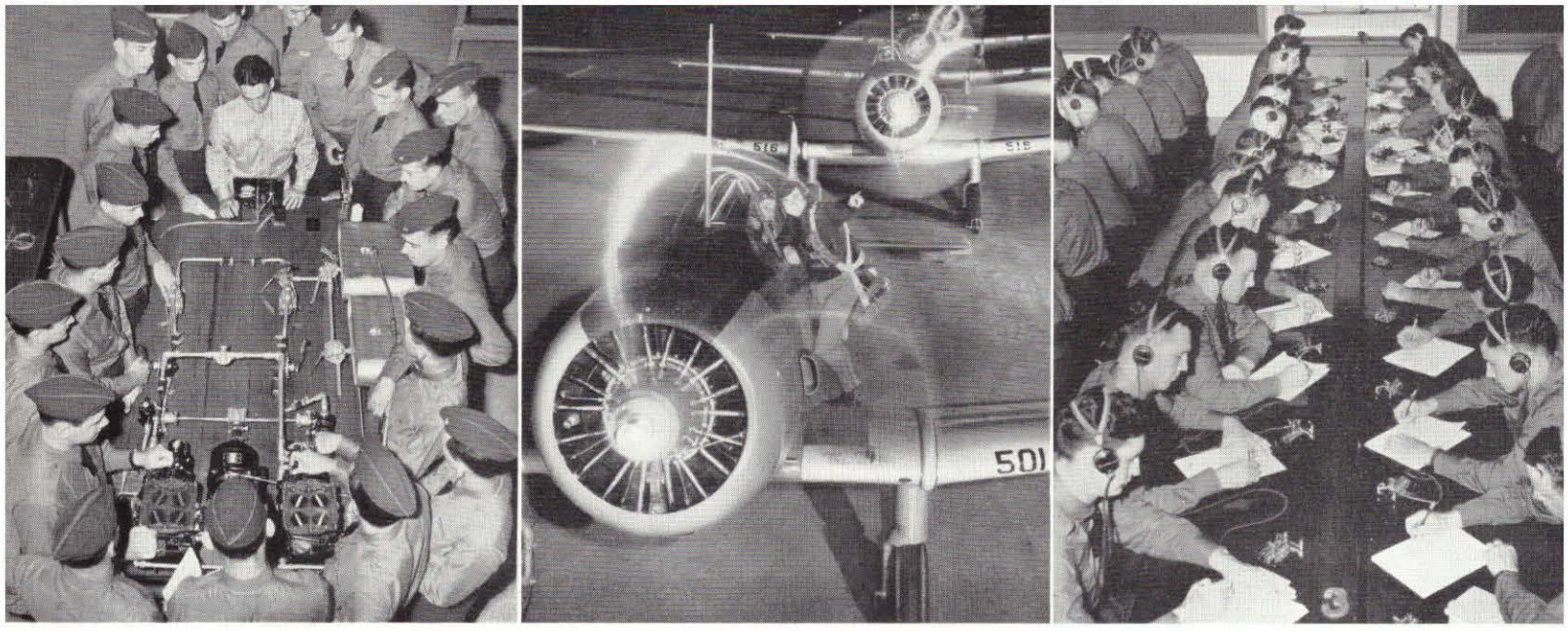
Further expansion of all facilities provided for an annual training rate of 12,000 pilots in 1941. This rate was actually reached with the graduation in November of a class of 1,200 aviation cadets, which started last March with a membership of 2,091. The "attrition rate" here was less than 40%.

To provide pilots and combat crews under the 84-group program, the rate will be almost tripled for 1942. Under present plans, by the end of June of this year, the rate of 30,000 pilots annually is expected to be reached. Other members of the combat crew in addition to the pilot will add up to another 10,000 per year. These include such highly trained specialists as the bombardier, navigator, aerial engineer, radio operator, machine gunner, and observer.

In order to reach this amazing total there will be in operation some 41 primary training, 18 basic training, 21 advanced, and 3 flexible gunnery schools, a total of 83. This network is spread out through the South and Southern California, where all-year training is possible, and is divided into three great Air Corps Training Centers as follows: The Southeast Training Center, with headquarters at Maxwell field, Montgomery, Ala-

OFFICIAL PHOTOGRAPH, U. S. ARMY AIR CORPS

At left: Aviation cadets billow a parachute into the breeze at Randolph field, Texas.



OFFICIAL PHOTOGRAPHS, U. S. ARMY AIR CORPS

At upper left, the complete fuel system of an airplane, mounted on a display board, is used for ground instruction at Randolph field. In the center photo, whirling propellers become silver disks under the floodlights as Flying Cadets taxi to the line for practice in night flying. At right, future pilots diligently practice sending and receiving code by radio.

bama; the Gulf Coast Training Center, headquarters, Randolph field, San Antonio, Texas; and the West Coast Training Center with headquarters at Santa Ana, California. The Southeast Center has 31 schools, including 16 primary, 6 basic, and 9 advanced, single-engine, two-engine, air navigation, and flexible gunnery units. The Gulf Coast Center also has 31 schools—16 primary, 6 basic and 9 advanced—while the West Coast Center has 21 schools, 9 for primary flight training, 6 for basic, and 6 for advanced.

During peace-time, the complete flight training course required one year. Without relinquishing high standards, and with continued emphasis on quality of output, the course has been condensed to speed up the process for the present emergency. An aviation cadet now spends his first five weeks at one of the three pilot replacement centers, then progresses to ten weeks of elementary flight training in a civilian school, followed by ten weeks at a military basic flying school. After this he will spend ten weeks at an advanced flying school. Many students take a course of five or six weeks at special schools for flexible gunnery, bombardment, and air navigation.

At the end of this period of 35 weeks, our now highly-trained officer is ready to report for duty with a tactical unit in the Air Force Combat Command. It will be of interest to note that under the British Commonwealth Training Plan, the Royal Canadian Air Force pilot receives eight weeks of initial training school instruction, eight weeks of elementary flight training, and 12 weeks of service flying training, a total of 28 weeks as against our Air Corps' 35 weeks.

Since the Replacement Center is a fairly new idea, it might be well to outline its functions. It provides a short military orientation course. Instead of learning something of the theory of flight, parts of an airplane and related matters, the new recruit takes up ground drill, customs of the service, and other basic military subjects, principles and practices needed by all military personnel. By this means, when an aviation cadet enters his flight training course he can concentrate entirely on flying and technical ground school subjects. The prospective pilot spends five weeks at the replacement center, while men classified for the combat crew replacement wing, including potential navigators, bombardiers, and observers will take ten weeks' training.

PHOTO BY SOUTHEAST AIR CORPS TRAINING CENTER

Oxygen mask snugly covering his nose and mouth, this aviation cadet at Maxwell field, Montgomery, Alabama, is ready to soar to altitudes at which air is so rarefied that normal breathing must be aided.

The elementary flying training course consists of ten weeks at one of the civilian flying schools, including 60 hours of flying training (an average of 28 dual and 32 solo), and 140 hours of academic instruction including 30 hours of meteorology. The subjects include airplanes, airplane engines, simple air navigation, weather observation, and mathematics. In flight instruction, the aviation cadet learns to fly such primary training ships as the Stearman biplane and the Ryan and Fairchild monoplanes, with average top speeds of 125 miles per hour.

At the end of the ten weeks he should be proficient in all fundamental maneuvers in primary trainers. A recent class of 146 members flew an aggregate of 3,866,100 miles without a fatality. Each member chalked up some 26,480 miles, farther than around the world at the equator. No other country in the world can spare aviation gasoline for anywhere near that much cadet flying, but we feel that it is essential to good pilotage and we have the gasoline.

Basic flying training is given at three civilian and 15 Air Corps flying schools, six in each training center, and constitutes a 10-week course. The flying program covers advanced maneuvers, spins, forced landings, formation flying, night flying, instrument flying, and the like. Ground school sessions include radio code, air navigation, weather observa-

PHOTO BY SOUTHEAST AIR CORPS TRAINING CENTER

While the airdrome officer, right, trains his glasses on an incoming ship, the sergeant awaits word to flash the blue light, indicating that "all's clear" on the landing field.

tion, airplane and engine operation. Airplanes used in the basic training program include such 450-h.p. ships as the Vultee BT-13 and BT-15, and the North American BT-14, with a top speed of 170 miles per hour, some 60 instruments, full radio equipment, and landing light apparatus for night flying.

Airplane as Weapon

In the advanced stage of pilot training, the aviation cadet learns to use the airplane as a weapon of war. There are two distinct courses, advanced single-engine pilot training, which teaches combat proficiency in single-engine military aircraft, and advanced twin-engine pilot training, which teaches combat proficiency for pilots of two-engine military aircraft. Since a great deal has been written during the past year or two on the primary and basic stages of pilot training, and not much on the rapidly developing advanced courses, it may be well to spend a little more time in discussing the latter.

In the ten weeks necessary to complete advanced single-engine pilot training, aviation cadets cover a broad field as pilots of single-engine advanced training military aircraft, and later as combat pilots of fighter aircraft, and qualify in basic duties common to junior officers of the Air Corps. Of the 237 air-ground hours spent in single-engine pilot training, some 118 are consumed in classroom and laboratory work, while 79 hours are actually spent in the clouds. An additional 80 hours are evenly divided between military training and athletics.

After 80 hours of flying, aviation cadets undergo transition from the relatively simple basic airplanes to more complex training ships, such as the North American AT-6 (also widely used by the British as the Harvard advanced trainer) and also gain some instruction in available tactical types such as the P-35 and P-36. After assignment to squadrons in the combat command, they are ready to step into our newest single-engine fighter planes, such as the Curtiss P-40, the Bell P-39 (Airacobra), and the Republic P-43. There is also plenty of practice in formation flying, navigation, and ground and aerial gunnery.

Ground school instruction covers such subjects as armament, tactics and technique of air fighting, squadron duties, maintenance engineering, antiaircraft, and signal communications. Some 45 different textbooks and many special Air Corps circulars provide the material for study. There are seven single engine advanced training schools in the three regional training centers.

Twin-engine pilot training is also a 10-week course, and embraces 247 air-ground hours, with 121 hours for hangar and laboratory work, 70 to 78 hours of actual flying, and 20 hours each for military training and athletics. Most of the time in the ground school is set aside for the study of armament and gunnery after students are thoroughly familiar with equipment and technical operations instruction.

Studies Comprehensive

Technical orders and shop practice, as well as tactics and technique of bombardment aviation, are studied along with the theory of bombing, duties of squadron officers, maintenance engineering, employment of aviation in the Army, bombing trainer study, radio and dead reckoning air navigation, combat orders, signal communications, tactical fire and reconnaissance aviation, and search operations, in the order named.

During the allotted flying time in twin-engine pilot training, the aviation cadet progresses to advanced two-engine trainers and available service types. The trainers include twin-engine jobs by Beechcraft, Cessna, and Curtiss, and bombers include the Douglas B-18A and Lockheed ships. Night flying, advanced formation drills, and instrument flying are practiced in both training airplanes and bombing aircraft. In all three regional Air Corps Training Centers there are 12 two-engine advanced training schools. After this training the young flying officer is assigned to a bomber command squadron and flies our new medium bombers, such as the North American B-25 and Martin B-26. After considerable experience with these, some of our twin-engine pilots will be assigned to squadrons using our B-17 and B-24 heavy 4-engine bombers.

While one group of aviation cadets is picking up the fine points in becoming Army pilots, other groups are concentrating on highly technical subjects to complete the rosters of the Air Force combat teams and combat crews. For a long time, the term

"flier" was applied to the pilot only. More recently, however, it has been recognized that all members of the combat crew in military aircraft must be classed as military fliers.

The pilot's duties, including the take-off, the management, direction of the airplane in flight and its return safely to earth have been little changed. The duties and functions of the other members of the combat crew —the bombardier, navigator, aerial engineer, gunner, radio technician— have grown steadily year after year with the advent of new equipment requiring an ever-increasing dependence, for successful flight missions, on a multiple crew trained in perfect team play and coordination.

The U. S. Army Air Corps' emphasis on the strategic importance of the long-range heavy bomber has at last been amply vindicated. England has brought out the Short Stirling and Handley-Page Halifax. Germany has put into action the Focke-Wulf Kurier and Junkers Ju-96, while this country some months ago announced a goal of 500 heavy bombers per month of the Boeing B-17 and Consolidated B-24 types, admittedly the best in the world.

Streamlined Course

To operate these sky battleships, a tremendous number of combat crew members will be necessary. On Nov. 1, a streamlined joint navigator-bombardier course was inaugurated at the three Air Corps Replacement Centers, Maxwell field, Alabama, Ellington field, Texas, and Moffett field, California (to be shifted to Santa Ana when facilities are completed). Until now, navigators and bombardiers have been trained separately, but in combining the two courses the Air Corps plans to turn out many thousands of well-trained specialists by the end of 1942, augmenting the present training program.

The course is organized in four stages and is taken in four centers. The first consists of ten weeks at the Replacement Training Center, with two weeks of military processing and eight weeks of study covering maps and charts, ground forces, air forces, naval forces, and mathematics.

Cadets then proceed to one of the navigation schools, one of which has been conducted by Pan American Airways at Miami since August, 1940, or one of the three Air Corps schools at Turner field, Albany, Georgia; Kelly field, Texas; or Mather field, California. Here will be spent 15 weeks of what many will regard as the stiffest part of the course. Subjects include the art of navigation by pilotage, dead reckoning, radio navigation, celestial navigation, and how to use each method in conjunction with the others. Cadets also will study meteorology and practice in weather observation.

Following this are the 12 weeks at one of the five bombardier schools. Because of favorable weather conditions, these are all situated in the southwest. One is in the Gulf Coast Center, at Midland, Texas, and the other four are in the West Coast Center, at Albuquerque and Roswell, New Mexico; Higley, Arizona, and Victorville, Calif. Studies include the theory, practice, and use of our secret bombsight, meteorology, and practice in reading weather maps.

Including one week for travel between each of the centers, the course so far requires 39 weeks. Upon completion of the bombardier course, the aviation cadet will be commissioned a second lieutenant in the Army Air Corps and will be entitled to wear wings of special design, similar to those worn by Air Corps pilots.

The final stage in the course consists of five weeks in flexible gunnery to complete the officer's knowledge and usefulness as a member of the combat crew. Practice is given in firing of standardized machine guns and aerial cannon from standardized installation while in the air, at both ground and air targets at all combat ranges.

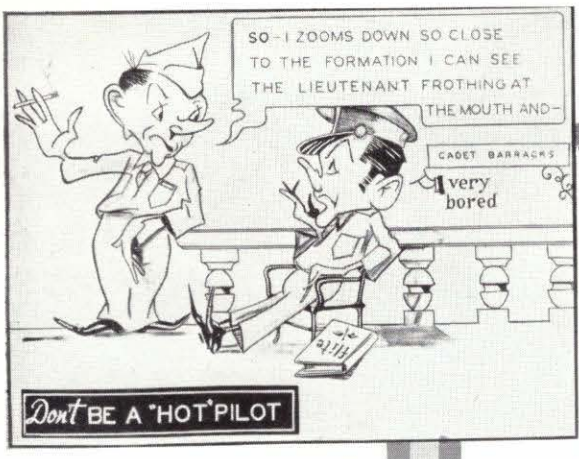
Courses for other members of the combat crew, including the aerial observer, flight engineer, radio operator, and rear gunner, are given to enlisted men in connection with the Air Corps training set-up.

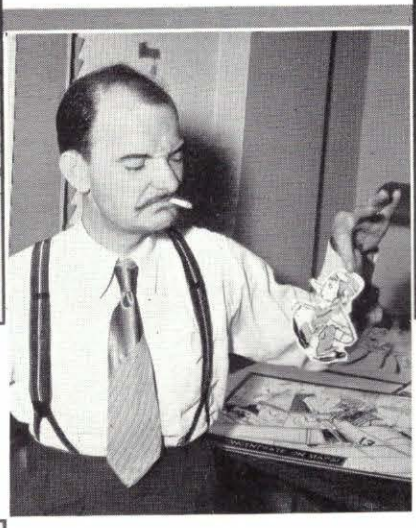
To round out the picture it should be remembered that a tremendous expansion of ground forces has been necessary. With 14 civilian schools for the courses in airplane and engine mechanics and five Air Corps schools for radio operation, photography, armament, weather observation, and other technical courses, a goal of 100,000 mechanics and technicians per year has been set for 1942.

America can have just as good an air force as it wants. We need the best in the world, and are well on the way toward getting it.

Intricate interior mechanism of the training planes at Randolph field is carefully checked daily by crews of highly-skilled mechanics. Undergoing inspection here is a North American trainer.

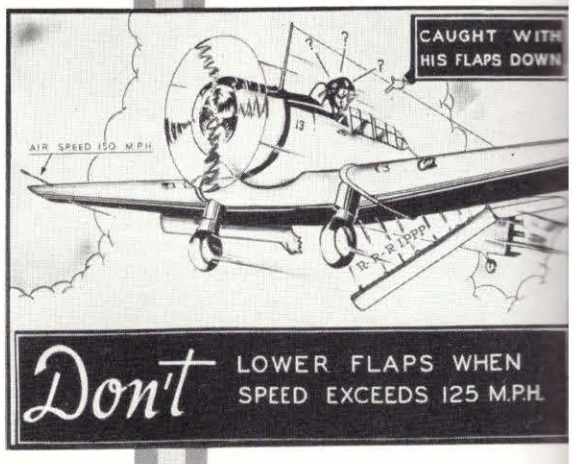
PHOTO BY AIR CORPS, RANDOLPH FIELD


SO-I ZOOMS DOWN SO CLOSE TO THE FORMATION I CAN SEE THE LIEUTENANT FROTHING AT THE MOUTH AND-
CADET BARRACKS
very bored
Don't BE A "HOT" PILOT



WELL - IT'S ONLY 14:03 AND I DON'T HAVE TO TAKE OFF TO 14:05!
Don't FAIL TO BE COMPLETELY READY FOR YOUR TAKE OFF AT THE DESIGNATED TIME.

Artist Jack Zumwalt of Randolph field registers profound disdain as he examines his brain child, Flying Cadet R. F. Knucklehead, who sprang full-grown from the drawing pen in response to demand for a character to illustrate what the Army Aviation Cadet should NOT be. Christened "Knucklehead" because this term has long been used in the Air Corps to describe the thick of skull, this little cartooned catastrophe is now setting horrible examples in a series of training films.



In common with many another Aviation Cadet, Knucklehead flies a North American BT-14 basic trainer, as may be seen from the drawings on this page. Because his brain was short-changed, Aviation Cadet Knucklehead has a very important job with the Army Air Corps. To Uncle Sam's Air Corps he'll always be a reminder that a fool and his plane are soon parted. Not awarded a first name because no one could think of anything insulting enough, he faces a life full of crashes, embarrassments, and gruesome grins.

Introducing-
FLYING CADET
R. F. KNUCKLEHEAD
~~Eminently qualified by assiduous practice to demonstrate many of the pilot's don'ts

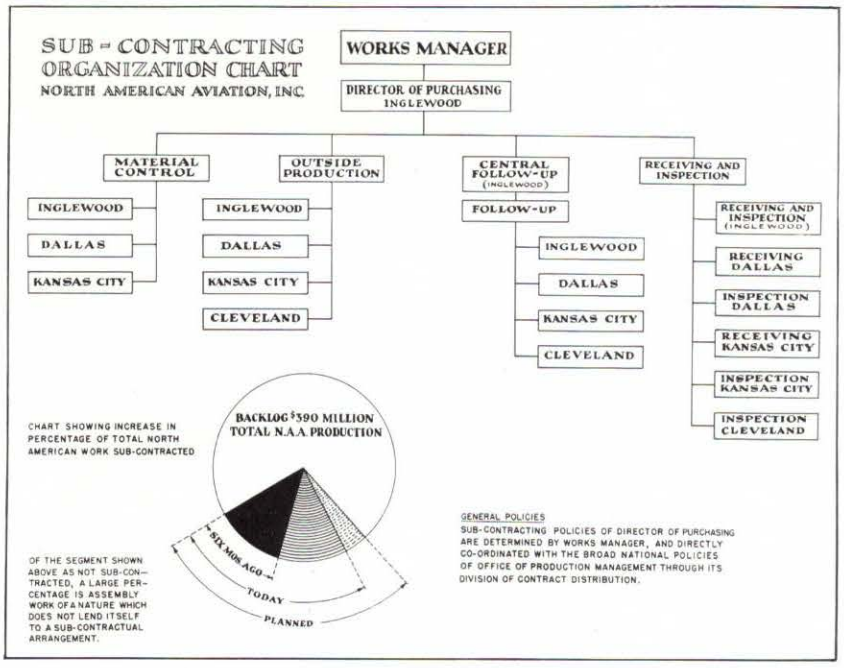
The star in a forthcoming series of instructional films being prepared at Randolph for circulation to Air Corps schools throughout the country, Aviation Cadet Knucklehead, the cartooned coo-coo, has been bombarded by fan mail suggesting nicknames and given names. Some of these were "Knucklehead, the Illegal Eagle," "Knucklehead, the Gliding Goon," and "Knucklehead, the Addled Albatross," but the prize — an autographed picture of the infamous cadet himself — went to Tom Ham, Georgia newspaperman, who tagged him "Stuporman."

ONE STRAWBERRY ICE CREAM CONE PLEASE! —
Don't LAND OUTSIDE SPECIFIED AREA WITHOUT AUTHORITY EXCEPT IN AN EMERGENCY!
ICE CREAM

Cooperative Production Meets Mounting Demands

Sub-Contracting Described as Formula To Attain Immediate Maximum Output

By Robert Monroe
Director of Purchasing, North American Aviation, Inc.
(Reprinted from Aviation *magazine, December, 1941)*



Spurred by the deepening war crisis, our government has asked industry to perform a "miracle of production." We are told that our efforts must be so intensified as to double, triple, or even quadruple the volume of tanks, planes, and war weapons flowing to the battlefields.

For the young aviation industry, this demand has been particularly difficult. In 1941 we already have expanded production of American war planes to many times what it was only three short years ago. Yet on top of this apparent miracle we are urged to produce another, and to increase our production to twenty times what it was before the war emergency developed.

The reason is obvious. The military airplane is the spearhead of modern warfare. It is the sharp point which drives to the vitals of enemy resistance and opens a way for older and slower methods of combat.

Since air power is the vital factor in our formula for victory, we must produce a miracle of airplane production.

If there is a miracle still to be performed, it is a very simple one. It is simply the miracle of teamwork, which will make it possible for the aviation industry of this country, in cooperation with government and other industries, to make use of existing tools and facilities, and of existing reservoirs of skilled workers, to achieve the maximum immediate result in expanded production without having to wait for the completion of new factories, the construction of new machine tools, and the training of new men.

One formula for such a cooperative effort is sub-contracting. By breaking down the complete airplane into the maximum number of component parts and items of equipment, we are able to spread the manufacture of such items throughout the industrial fabric of the entire nation.

But sub-contracting has two sides. There are obvious advantages to the scheme of spreading our production problem, and there are some serious disadvantages, not all of them obvious. To overcome these difficulties we must rely on the miracle factor in our formula—the human element of teamwork and cooperation with each other in order that we may all mutually give and take to achieve a common supreme purpose.

Immediate expansion of production is the major advantage of sub-contracting. Theoretically, it is possible to allocate almost half the work of building an airplane to plants which have previously been engaged in other work. Thus we would simply send production blueprints and specifications, along with a contract specifying the number of parts wanted, date delivery is required, and the amount we will pay for the work, to a factory which is not too busy with other work. This might be a manufacturer of automobiles, refrigerators, or radios. It might be an independent machine shop, an accessories manufacturer, or a toy-maker.

The theory of marshalling hundreds of such shops into an army of aircraft parts producers is an attractive one. It is easy to picture such an overnight expansion of the aircraft production effort. One's imagination leaps at the possibility of a great host of such plants feeding in parts and assemblies to a few central aircraft assembly centers, out of which roll

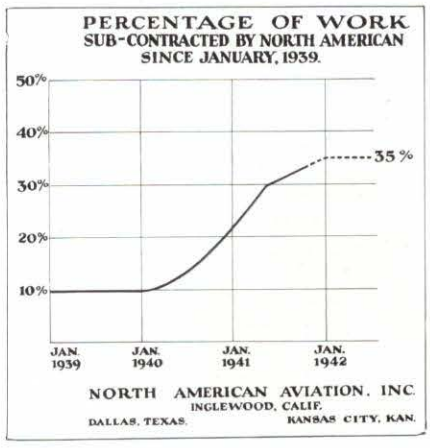
Robert Monroe, the author of this article, joined North American as purchasing agent in 1935. His association with aviation dates back to 1929.

the completed planes for our military services.

There are other points favoring sub-contracting. As we gear our industrial effort to war needs, inevitable dislocations occur. Priority control of essential materials reduces employment in many industries producing for peacetime needs. Workers are laid off and whole towns suffer economic blight if no war work is immediately available for the plants formerly engaged in non-defense production. Extension of sub-contracting offers a method of counteracting this economic dislocation.

By sending orders for aircraft parts to areas formerly engaged in civilian production work, it is possible to avoid the social and economic ills resulting from migration of workers from one area to another. Local merchants and business institutions, local schools and civic organizations, local labor, industry, and political procedures are all maintained on an even level. It is quite obvious that the benefits of an efficient sub-contracting program are of basic importance to the whole nation, as well as being of paramount importance in obtaining immediate stimulation of our production effort.

But like every good thing in life, this sub-contracting scheme is not to be successfully accomplished by overnight, spur-of-the-moment action. We have succeeded to date because we have proceeded step by step, through a process of trial-and-error education, and with the close cooperation of everyone concerned.



There have been many major problems to face. It is not at all easy to find plants capable of making aircraft parts to the required precision standards. Even the materials used in airplane manufacture, such as magnesium and aluminum alloys, are strange to most of the shops available for handling such work. Consequently, we have had to conduct a very thorough program of investigation of all prospective sub-contract plants.

Background Studies Made

We have had to study financial and labor background, as well as the physical shop facilities and the availability of trained craftsmen. We have had to allow for the possibility that a sub-contracting plant might experience financial failure while in the midst of executing an important contract. It is possible that some labor trouble in a small plant remote from assembly lines would rob us of important parts at a critical time, so we must do an intelligent job of appraising all firms which join our sub-contracting team.

Once associated with them in the production effort, we must seek the utmost cooperation with all such plants in order that our flow of parts may be efficient and uninterrupted. Their employes must be trained to understand all the special problems of producing parts for us. This training concerns tooling, jigs, fixtures, and inspection, and is in itself an important and time-consuming operation.

As we shift the production of parts and assemblies to sub-contractors, we face a major problem in providing a sufficient stock of such parts to keep our production line going while the new supplier is getting set up. And we always have the worry that a parts shortage may result on some critical item because of spoilage of a production run at some remote plant.

These potential headaches, plus the constant difficulty of finding and training sufficient executive and supervisory personnel to make it possible to keep the whole complicated machinery of a major sub-contracting effort in motion, well illustrate the difficulties in the way of accomplishing the required production miracle.

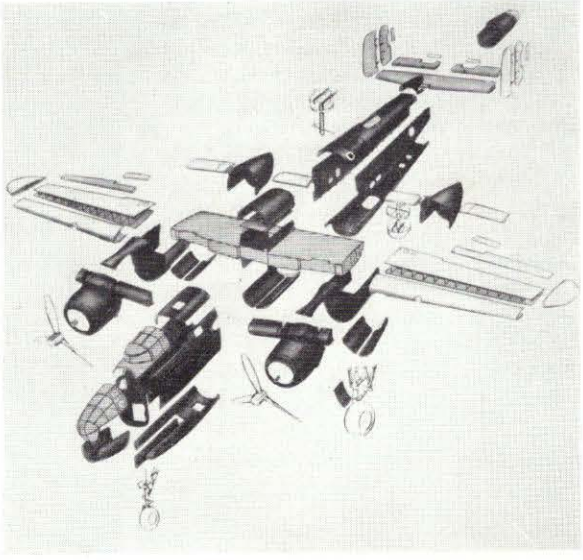
But in spite of these problems, we have achieved tremendous progress, with the help of all those engaged in this effort. Our purchases of parts and materials from outside sources reached a total of more than $100,000,000 for the year 1941, as compared with $45,000,000 in 1940. And percentage-wise, we stepped up sub-contracting from about 15 per cent of our total production early in 1940 to approximately 30 per cent on Nov. 1, with an anticipated eventual total of 34 per cent. It should be remembered that 34 per cent of our total production represents a very much greater proportion of possible sub-contracting, since something like half our total work must be done in the primary plant.

Our production team now has grown to such huge proportions that it includes 65 major sub-contractors and more than 900 suppliers of parts and materials, with plants spread throughout every one of the 48 states. These plants all feed parts and supplies to our three factories, in Inglewood, Dallas, and Kansas City, Kansas.

While all sub-contracting is supervised from the parent organization in Inglewood, California, we have found it necessary to establish a sub-contracting administration office at Cleveland, Ohio. This office facilitates the work of developing and controlling sub-contracting throughout the eastern half of the United States.

In developing this great sub-contracting effort, North American Aviation has had the fullest encouragement and cooperation from the

Dark- and light-shaded areas in this breakdown chart of North American's B-25C bomber indicate parts and assemblies furnished by Fisher Body. White areas—landing gears, propellers, gun turrets—indicate purchased parts.



Supervisor of outside production at North American's Inglewood plant is Rudy Mufich, shown here perusing a blueprint as he converses with a representative of one of the shops engaged in subcontractual work for North American.

government, and especially from the Office of Production Management, which has actively fostered the subcontracting procedure. Other industries, notably the automobile industry, have played a major part in making possible the great progress which has already been achieved.

While Ford, Chrysler, and other manufacturers have worked with other branches of the aviation industry in this connection, it has been our good fortune to have had the close cooperation of the General Motors Corporation. This has made it possible to take advantage of an established administrative procedure, and an executive and supervisory personnel which operates an integrated nation-wide industrial empire.

Through the assistance of General Motors, many of the problems of finding suitable plants for manufacturing specific parts of our planes have been eliminated. Thus we have been able to work through one central administrative office, and through it reach and maintain efficient relations with hundreds of small industrial units of all kinds scattered throughout the entire country. This advantageous relationship will continue throughout the period of the emergency and will work to the mutual advantage of our own company, the General Motors group, and the entire nation, which needs this expanded production of vital weapons.

Another phase of sub-contracting which we are developing to advantage concerns the manufacture of replacement parts for older models of aircraft now in service. We can turn over jigs and fixtures to plants which are able to manufacture such replacement parts efficiently. Through careful supervision we are able to assure the customer, whether it be the U. S. Army Air Corps, or the air services of Peru, Argentina, or China, that replacement parts will be supplied to meet original specifications. Yet our parent plant will be freed of the necessity of conducting such small scale manufacturing, which would interfere materially with our mass-production effort on modern military planes now needed for actual combat.

We have been particularly fortunate with respect to sub-contracting in that our plant was one of the first to break down an airplane for production into the maximum number of sub-assemblies and component parts. We pioneered in spreading the sub-assembly work back through the shop, doing a minimum of work on the final assembly line. The system proved to have many advantages. But the greatest advantage of all appears now in the ease with which we can allocate these various component parts and sub-assemblies to outside manufacturers for fabrication and assembly.

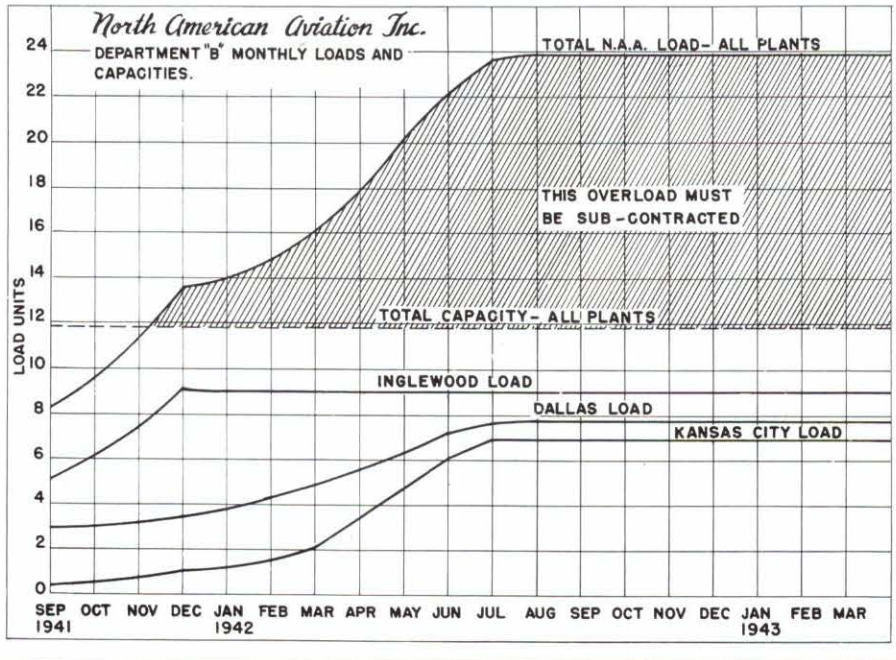
Our experience with assembly problems over a period of years has helped to discover in advance and eliminate many of the difficulties which arise when a product is put together from sub-assemblies manufactured in various remote plants.

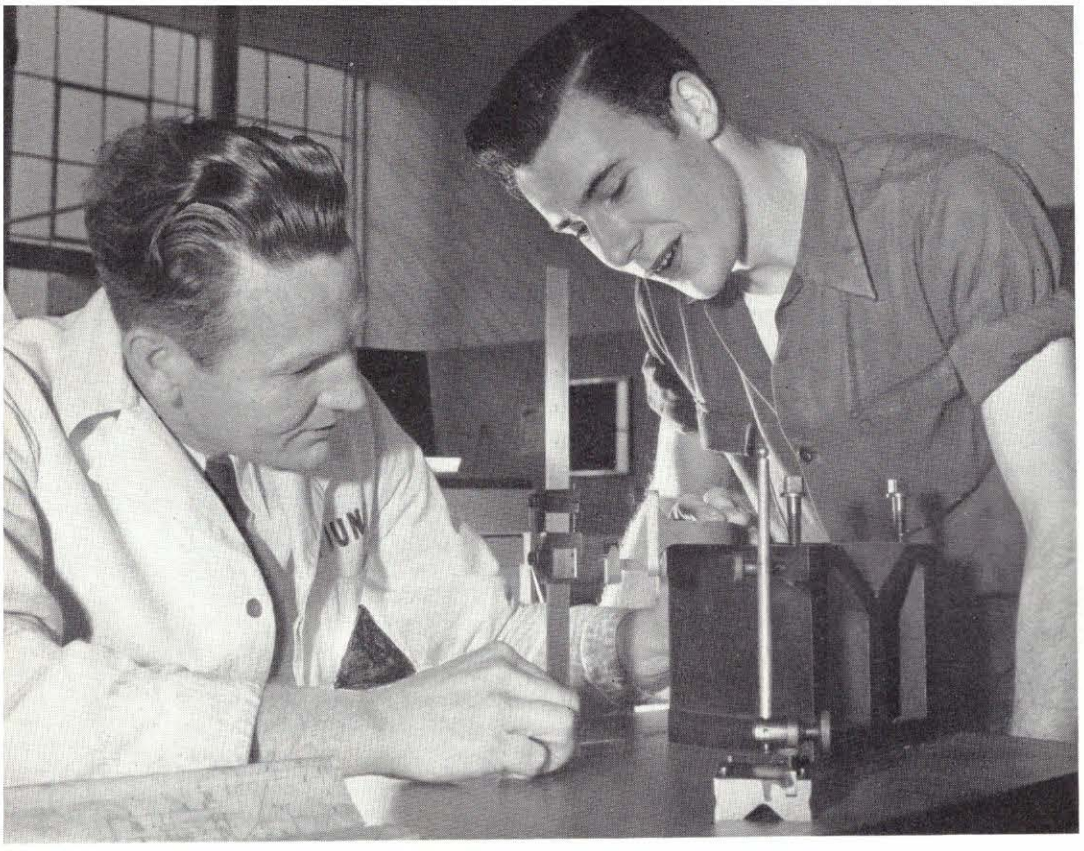
The detailed procedure which we have worked out for placing sub-contracts and for administering the network of plants and suppliers who cooperate with us on the over-all sub-contracting effort is too involved for a complete explanation in the space available here. But it may be of interest to sketch in the outline of how we go about sub-contracting.

Specifications and drawings are developed in the engineering department, which works closely with the shop. Engineering personnel has in mind the problems of sub-contracting in the course of preparing the original design, and does what it can to develop the design so that it will

(Turn to Page 40)

THIS IS AN EXAMPLE OF THE DEPARTMENTAL LOAD STUDIES WHICH DETERMINE THE AMOUNT OF WORK TO BE SUB-CONTRACTED





John F. Young, left, instructor at the Frank Wiggins aircraft trade school, shows Morton R. Oleson how to use a height gauge in precision inspection.

New Aircraft School Graduates Students from Class to Shop

Talk with any first-class machinist and he'll tell you that machinists are made, not born. True, some natural aptitude must be in evidence, but only years of training can mold the raw recruit into an A-1 craftsman.

There aren't any short cuts to experience, but the Los Angeles City school system has originated an apprentice course that is giving the proper start to a lot of future machine shop workers.

At 9700 Sepulveda boulevard, the Los Angeles board of education has built a branch of the Frank Wiggins Trade school to supply the expanding aircraft industry with semi-skilled machinists.

Students are chosen by North American's personnel department. Applicants who seem to have the ability to become machinists, yet lack the necessary background to enter the trade, are recommended to the school.

As soon as a student is enrolled, he is placed on North American's payroll. After 10 weeks of intensive study, he transfers from the school to the company's machine shop. Approximately 15 men have been placed in Dept. 1 since the school opened last Oct. 4.

Because of its location—the west end of the Los Angeles airport—the new educational unit might be mistaken for a country school, but a tour through the unit would quickly correct any such impression. Classes are held in a $50,000 building, covering 10,000 square feet of floor space. Six classroom bungalows have been added to the "campus" for future use. In addition to a machine shop, the main building includes a completely-equipped tool crib, locker space, and washroom facilities. Machinery will represent an investment of approximately $250,000.

Although the unit is modern in every detail, taxpayers need not worry about their money being spent for frills. Under the guidance of three veteran NAA machinists, an intensive regimen is strictly followed during the 10-week period. Beginning at 6 a.m., students work eight hours daily on actual machined parts. More than a dozen truckloads of parts have been delivered to North American since the start of the program.

Classes are limited to 30 or 35 men, and are apportioned among the teachers so that individual instruction is possible. After a man has become acquainted with the intricacies of one machine, he progresses to another. By this method, each man acquires a thorough knowledge of the various machines and the operations they perform. A North American inspector is on duty during classes to approve all work leaving the school, and his low rejection figures speak for themselves. Supplementing the day classes are night sessions twice a week in blueprint reading and shop math.

Principal of the Frank Wiggins Aircraft branch is Ralph Hatton, for three years a machine shop inspector at North American. Before coming to NAA, Hatton was general machine shop foreman with United States Steel for 12 years.

Assisting Hatton are John D. Young and Conrad Walters, both on a leave of absence from North American. Young has nearly 10 years of machine shop experience behind him, while Walters has been a tool maker at NAA for five years.

"In conducting classes," says Hatton, "we try as nearly as possible to work under actual shop conditions. We also teach safety and the value of keeping the shop neat. We're proud of the fact that we've never had a complaint about any of our graduates."

Hatton keeps in touch with vocational teachers throughout Los Angeles county to keep the school abreast of latest developments. Not only is the school providing new workmen for North American, but it also serves to provide additional training for men already in the shop. Classes in shop math and blueprint reading are held Wednesday and Friday nights. These are taught by Cyril Roberts, NAA inspector, and Melvin Laird, of shop contact.

When all equipment has been installed, additional instructors will teach supplementary shop courses to men employed during the day. These classes are planned to run for three months. Approximately 160 men will receive instruction during each period.

THROUGH THESE PORTALS . . .

. . . pass men who built the first bomber produced by an inland plant. These pages commemorate the start of production in North American Aviation's great Kansas City Assembly unit.

This month we had planned an extensive dedication ceremony in the Kansas City bomber assembly plant which North American will operate. It was to have been a dedication of production rather than a dedication of a plant, and it was to have been climaxed by the delivery of the first Kansas City-built B-25 bomber to Lieut. General Henry H. Arnold, representing the Army Air Forces.

War in the Pacific—swift, deadly, and treacherous—has completely removed all thought of dedications from our mind. Now our job is a grim job of production, and we have no time for the pageantry which America loves in days of peace.

The war broke out on December 7. Just 16 days later, on December 23, North American's Kansas City organization had completed the first B-25 bomber, exactly 17 days ahead of the pre-war schedule. We had intended to deliver the airplane at the dedication ceremonies on January 9; I like to think of it now as a Christmas present for Japanese and German aggressors, with many more like it on the way.

As we enter a new year under the heavy shadow of a war which we must and will win, employes in North American Aviation's three plants are engaged in the battle of production with a new determination.

Whenever production counts in the final score, America is playing on its home field.

J. H. Kindelberger

President.

This was the scene on the Inglewood flight ramp the memorable day of December 8, when 10,000 North American employes silenced their lathes, drill presses, and rivet guns to hear President Roosevelt's war message to Congress, followed by an appeal from President J. H. Kindelberger.

War Cancels Kansas City Bomber Plant Dedication

Production Is Started Without Fanfare; Important Figures Send Congratulations

When the gauntlet of war was flung down before the United States December 7, a great many carefully-laid plans had to be discarded to clear the way for new and more commanding exigencies. Among these were the arrangements which had been made for formal dedication of the vast new bomber assembly plant being operated at Kansas City, Kansas, by North American Aviation for the United States government.

Meeting the next day, officials of the company decided that any formal opening program such as had been contemplated would be inappropriate under the circumstances, and it was agreed to call off the ceremonies altogether. As one of them expressed it, "We feel that the proper dedication of the plant will be the production of bombers."

Instead of the crowd of fifty thousand persons which had been expected to tour the great factory—first inland bomber plant completed under the national defense program—during the period from January 9 to 11, there were to be found only workmen going swiftly ahead with their jobs.

Chief roles at the dedicatory ceremony scheduled for January 9 were to have been taken by the men whose greetings and photographs appear on the succeeding two pages—William S. Knudsen, Director General of the Office of Production Management; Lieutenant General Henry H. Arnold, Deputy Chief of Staff for Air, United States Army; Alfred P. Sloan, Jr., Chairman of the Board of Directors, General Motors Corporation; C. E. Wilson, President of General Motors Corporation; Ernest R. Breech, Chairman of the Board of Directors, North American Aviation, Inc.; Governor Payne Ratner of Kansas, Governor Forrest C. Donnell of Missouri, and Major General Eugene Reybold, Chief of Engineers, United States Army.

Their words, expressing satisfaction that this great new bastion of democracy had been made ready for use in so short a time, were written before the United States had been drawn into the war. It is interesting to remark that these expressions remained as appropriate for publication.

While outwardly, then, there will be no dedication of North American's Kansas City plant, a re-dedication to the task at hand has already taken place, not only at Kansas City, but throughout the company's organization.

Its keynote was sounded on a chill, dark day in December by President J. H. Kindelberger when he addressed 10,000 Inglewood employes who stood tense and silent on the flight ramp after hearing President Roosevelt's war message to Congress. In earnest, solemn tones, Kindelberger redefined North American's responsibility, and appealed for renewed effort to "keep them rolling out the door."

That was a day of re-dedication.

Moving Forward Together

Ernest R. Breech

Chairman of the Board of Directors, North American Aviation, Inc.

The Kansas City plant of North American Aviation, Inc., is proof that a democratic nation can move with efficiency and speed in the mobilization not only of its Army and Navy, but of its industrial genius as well.

This is the answer of a free people to the challenge of the dictators. With the continued cooperation of the men and women who will henceforth produce bombers in this plant in ever-increasing numbers, the defense of that freedom will be assured.

I have first-hand knowledge of the great effort which the organizations of North American Aviation and Fisher Body Division of General Motors Corporation have put forth to make this cooperative production program a success. Both organizations deserve the highest praise for this accomplishment.

★

Payne Ratner

Governor of the State of Kansas

The beginning of actual delivery of planes from the North American bomber assembly plant in Kansas City means reaching another objective in the defense of our country. The pride and satisfaction of Kansas and the Midwest in this achievement are shared by all America. To the people of my state, aviation preparedness has a special meaning because it is in tune, not only with the emergency of the hour, but with some of our most important hopes and plans for the years ahead.

Kansas has long been pioneer ground in the field of aviation. Because of our central location, geographically, our air fields are "at the crossways of the airways of the nation." Commercial planes which cross the continent from every direction find Kansas a convenient depot, as evidenced by our growing airline traffic. The topography of Kansas is well suited to pilot training, and our climate is such to permit good flying weather most of the year around.

With these natural advantages, it is small wonder that Kansas has furnished America many outstanding men and women in the field of aviation. In Kansas are some of the greatest aircraft factories of the United States, contributing now to the defense of our country, and holding forth rich promise of significant advancement when the emergency is over.

To us in Kansas, the North American plant at Kansas City is therefore vital both to our Midwestern effort to be of maximum service in the defense of America, and to the Kansas ambition to become of increasing importance as one of the great peacetime aircraft states of the Union.

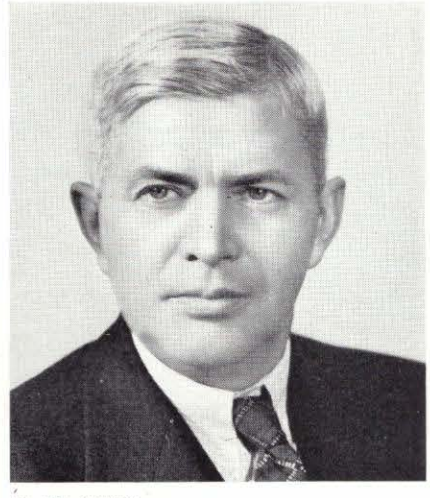
★

Maj. Gen. Eugene Reybold

Chief, United States Army Corps of Engineers

Satisfactory progress of the defense program has been possible largely because of experience of the Corps of Engineers, United States Army, in execution of large public works, and because of its decentralized construction organization set up for that purpose.

The four aircraft assembly plants, including that at Kansas City for operation by North American Aviation, are of particular interest to the Corps of Engineers in that their construction, involving many unusual features, has been a distinct departure from the normal type of work performed by the Corps, and in that they will be important factors in the nationwide effort to speed up military airplane production.



C. E. Wilson

President, General Motors Corporation

General Motors wishes North American Aviation, Inc., success in its new enterprise in the production of bombers in its fine new plant at Kansas City. The Corporation is more than pleased to have an important part in the manufacture of these bombers. In the Fisher Body Division sub-assemblies of wings and fuselages are now being made and shipped to Kansas City for final assembly.

While bomber sub-assemblies are an important part of our defense work, they are just one of General Motors' major undertakings in carrying out its defense obligations. In more than sixty plants in thirty-four cities, scattered from coast to coast, General Motors is making or preparing to make a wide variety of materials ranging from tiny ball bearings to tanks and trucks. Truly "Defense comes first with General Motors."

★

Forrest C. Donnell

Governor of the State of Missouri

The State of Missouri is greatly interested in the opening of the Kansas City bomber plant of North American Aviation, Inc. We recognize that both the State of Missouri and the State of Kansas are jointly concerned in the inauguration of this great agency for National Defense. Missourians congratulate those who have charge of the project upon the success of their labors.

William S. Knudsen

Director General, Office of Production Management

In October, 1940, we were made acquainted with the first quantity requirements for heavy bombers. Four models existed, three of which were in experimental form, and the question before us was how best to tackle the production problem of planes weighing from 25,000 to 50,000 pounds.

The organization necessary to manufacture quantities of planes of this size would necessarily be large, and skilled airplane builders were few. I, therefore, with the consent of the Secretaries of War and Navy, appeared before the leaders of the automobile industry and secured their cooperation in the manufacturing part of the job, and four assembly plants were financed by the Government in which to assemble the planes. This Kansas City plant was assigned to North American Aviation, Inc., and designated to assemble B-25 bombers.

It is my privilege to compliment the United States Corps of Army Engineers, the contractors, and North American Aviation Corporation, for being on schedule and finishing ahead of the other three plants—not only in the building of the plant itself, but in being ready to assemble. It speaks well for the teamwork on the job and gives me great hope for the success of the assembling type of factory. Quantity production will be made possible, and quality can be maintained at the same time.

The secret of the success of any product involving technical and manufacturing processes is the accuracy with which the work is performed. Speed in production is the natural consequence of the good will created by the satisfaction of being a part of a job well done. To you men in the Kansas City plant of the North American Aviation Corporation, I extend my greetings and best wishes. Make a good plane—that is first, then you will make lots of them.

Your President Kindelberger is a skilled designer—you are skilled workers. The men in Fisher Body have lots of skill. Your plane is built on this 3-point suspension. Good luck, and I know you will succeed!

Lieut. General Henry H. Arnold

Deputy Chief of Staff, United States Army

It is now widely admitted that the strategic weapon par excellence for the security of the Western Hemisphere is the long range 4-engine heavy bomber. However, the provision of adequate air bases well distributed throughout the hemisphere reduces to some extent the necessity for long range. We are rapidly building up such bases in the Atlantic, the Pacific, the Caribbean, South America, and Alaska.

Using such bases, the long range bomber will be our first line of air defense. An important second line of defense, however, consists of a larger number of twin-engine medium bombing planes with an effective radius of action up to 1,000 miles, or a total range of well over 2,000 miles.

In this class, America has the finest in the world. One of these is the latest addition to our air forces, the husky 12-ton baby we know as the North American B-25C. This hard-hitting member of our striking power is one of the speediest bombers in the world, with a speed approaching that of the standard fighter planes in use abroad. It carries a very healthy load of bombs and operates at a high altitude. The tricycle landing gear makes for excellent take-off and landing qualities, and for a large ship it handles beautifully in the air.

The B-25C can definitely out-perform such well known medium bombers in use abroad as the R.A.F. Bristol Blenheim and the Dornier D-17 and Heinkel 111K of the Luftwaffe, even in their stepped-up versions. The pilots in our Air Force's Bombardment Command literally threw their caps in the air when they began receiving B-25's last spring. Here was a chance to climb into a really hot ship and put it through its paces after loafing around in B-18A's for so long.

The B-25C's are rolling off in great style at North American's Inglewood factory, and by early spring the output will be greatly augmented by production at the new $10,000,000 government built factory in Kansas City.

You keep 'em rolling, boys, and we'll keep 'em flying!

Alfred P. Sloan, Jr.

Chairman of the Board of Directors, General Motors Corporation

General Motors sends greetings to North American Aviation and congratulates Mr. Kindelberger, his associates, and the entire organization, on adding another remarkable achievement to its many outstanding records—the development of the new assembly plant at Kansas City.

Such achievements must be measured by both the magnitude of the performance and the time element involved; this because both are essential requisites in achieving the great objective to which the nation is prepared to devote all its resources. Now we move forward and weld together the managerial and technical talents of two outstanding American industries.

This joint attack on a common and vital problem involves a spirit of cooperation and coordination, absolutely essential throughout the whole front of American industry if we are to marshal the nation's resources into a single intelligently-directed objective. We must recognize that in these times of national danger, our individual objectives, highly essential to progress in normal times, must be subordinated to a single purpose. The idea of a coordination of the strength within these two great industries was an outstanding conception. It always takes courage and imagination to advance something new and different, and it takes ability and resourcefulness to accomplish the purpose.

Likewise, there are involved important managerial and technical problems. The specification of each individual piece must be defined to the minutest detail in order that, irrespective of the conditions of manufacture, all parts may be brought together into a properly constituted whole. While such an approach is well recognized in our mass production processes, this I believe is its first broad application in the manufacture of a great and complicated structure, such as the modern bomber can well be said to be.

The natural resources of our nation, its manufacturing technique as developed over years of constructive effort, provide every single component necessary to win the war, but the magnitude of the job superimposes the additional elements of coordination and time. That is why it is so important that this added achievement of North American, in again showing the way to a great coordinated performance, is perhaps its greatest contribution to the cause of national defense.

A seemingly endless line of front fuselage sections is presented to the eye by the recently-installed conveyor assembly line in Dept. 37 of North American's Inglewood plant.

Huge Industrial Empires Join Forces to Produce Warplanes

Imagine, for a moment, a gigantic bomber, several hundred square miles in size. Soaring across the United States, its wings would spread between Memphis, Tennessee, and Lake Superior, while its fuselage would be visible from Detroit, Michigan, to Kansas City, Kansas.

Although this presents a fantastic picture, even in this age of startling aviation developments, it serves to illustrate the scope of the cooperative program North American Aviation and General Motors have set up to produce the powerful B-25C medium bombers at Kansas City.

These two organizations, in the words of J. H. Kindelberger, president of North American, have "teamed together" for the manufacture of airplanes needed by the United States Army Air Corps. It is the most remarkable example of inter-industry coordination since the outset of the national defense program. Other aviation and automotive concerns are also preparing to merge their facilities to provide for a greater output of these essential products of modern warfare.

The idea was first conceived by C. E. Wilson, president of General Motors, as the most logical solution to the problem which confronted the aviation industry last year when it was called upon to build planes in vaster quantities than was dreamed possible only a few years ago. It became apparent to aviation leaders that to meet this demand, sub-contracting would be necessary to provide a considerable share of the parts.

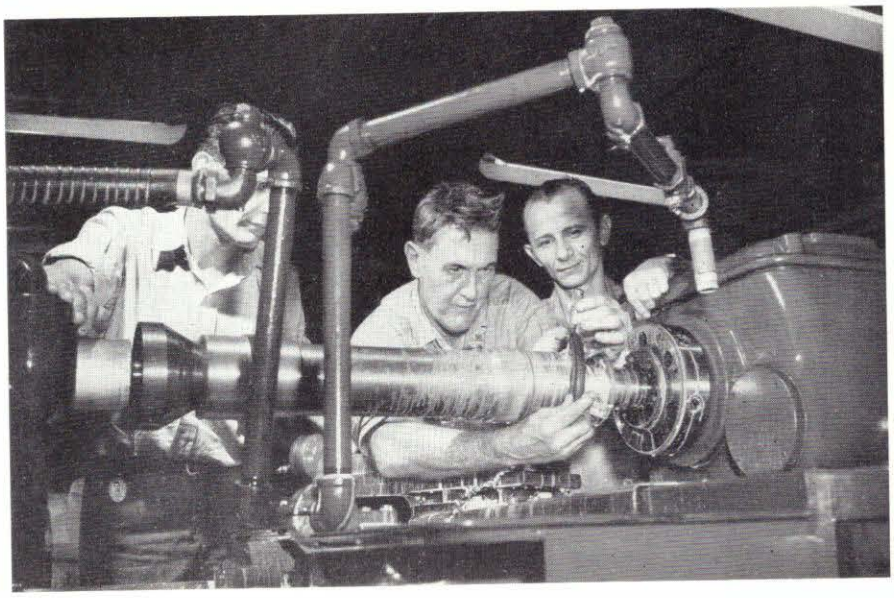
Reduced to simplest terms, the job involved having the aviation industry outline its needs to the automotive industry, provide specifications, aid with tooling, and then bring the finished parts to its own plants and assemble the airplanes under its own supervision.

The "production team" of North American and General Motors was the first to place this program in operation late last year when the United States Government asked North American to design and prepare to operate a $10,000,000 blackout bomber assembly plant at Kansas City. North American, because of its proved production methods, was ideally suited to test such a plan of inter-industry coordination. General Motors, with its huge manufacturing resources, appeared to be the logical partner for such a venture.

In advance of the production of its share of bomber sections, General Motors was furnished with one hundred sets of detail parts, enabling the Fisher Body Division of General Motors to set up its sub-assembly plants and put them into operation.

Many weeks before the first bomber was scheduled to roll out onto the Fairfax field runway at Kansas City, trucks and trains loaded with the subassembly parts were converging on the factory to furnish the sections for the first three bombers which have been assembled in the Kansas City plant.

This meant something like this: wings, flaps, ailerons, wing tips, hor-



At left, a machining operation is being performed on the outer cylinder of a main landing gear oleo strut at the Delco Products Division of General Motors corporation at Dayton, Ohio.

izontal stabilizers, vertical stabilizers, rudders, elevators, nacelles, bomb bay doors, wing center section leading edges, inboard and outboard, built by the Fisher plant at Memphis, Tennessee, were rolling to North American's bomber assembly plant as systematically as from one department to another in an aircraft plant.

At the same time, similar caravans were moving westward from the heart of the industrial sections of Michigan, bringing from Detroit bomb racks, front and rear spars, pilot's and bombardier's enclosures, engine cowlings, fabricated glass, and droppable fuel tanks, direct to the assembly line.

Initial production at the Memphis plant included 17 different types of bomber sections, and as the organization was geared up to full scale production, 287 different types of sections and assemblies were being made, ranging from rough aluminum alloy forgings up to the 19-foot outer wing panel assemblies.

The work being done by the company illustrates in part the great production problems being tackled constantly by the aviation industry in the present national emergency. Each shipment of sections for one bomber made to the assembly plant will have 18,000 parts and 107,000 rivets. The sub-assemblies produced by this organization, however, excludes the center section and government-furnished equipment, such as engines and instruments.

By furnishing sets of parts to Fisher Body, North American made possible the production of parts several months sooner than was otherwise deemed possible. Because North American furnished plans on schedule and contributed its engineering knowledge, while Fisher Body simultaneously removed unsuitable machinery, replacing it with the proper equipment, production began without delay.

This plan has had mutually benefical results for both organizations. By the time these sets were assembled and built into sub-assemblies, the automotive industry had profited by a unique opportunity to learn a great deal about building airplanes. On the other hand, North American will be provided with well-built parts as fast as they are needed, permitting the production of more airplanes at Kansas City than have been asked.

While the automotive industry was thus engaged in carrying out its part in the coordinated productive program, the vanguard of a mighty industrial "army behind the army" which will be at work in 1942 was being carefully trained by North American at Kansas City.

When the first sets of sub-assemblies arrived at Fairfax field, the stage was set. As the parts were brought into the factory from the various Fisher Body units and from North American's Inglewood plant, the company was ready to operate the assembly line and construct the first bombers.

Nine Fisher Body plants are participating in the work of bomber subassembly production for the Kansas City factory at present.

Manufacture of parts not being supplied by Fisher has been undertaken by the Kansas City plant, and some of this work is being apportioned to independent Kansas City firms, the Inglewood plant, and various independent firms in Southern California. Whenever possible, non-productive materials are being purchased from Kansas City firms.

A liaison division has been set up within North American's organization, collaborating with a special section of the Fisher division, known as the Aircraft Section, and in this way production is being efficiently coordinated.

Company Institutes Bond Purchase Plan

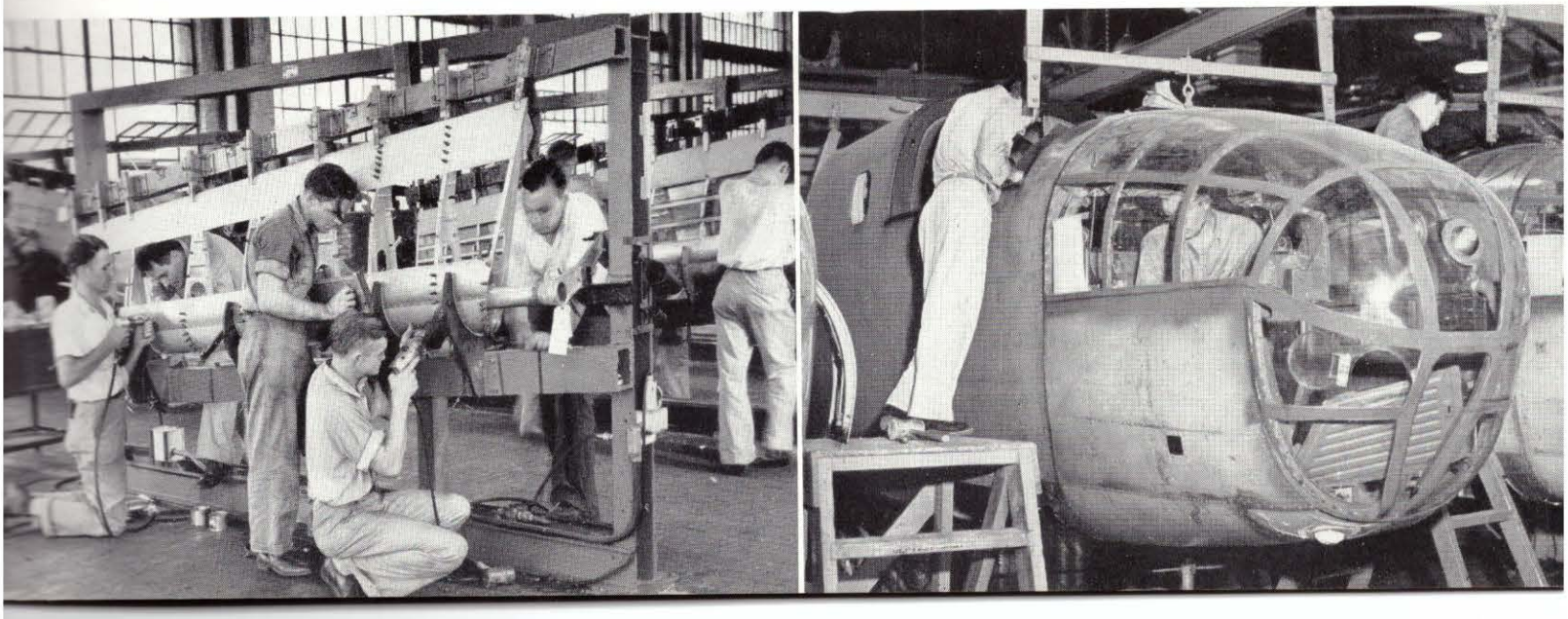
Sale of United States Defense Savings bonds by means of voluntary payroll deductions was inaugurated at the Inglewood factory Jan. 1 under a plan instituted by the management.

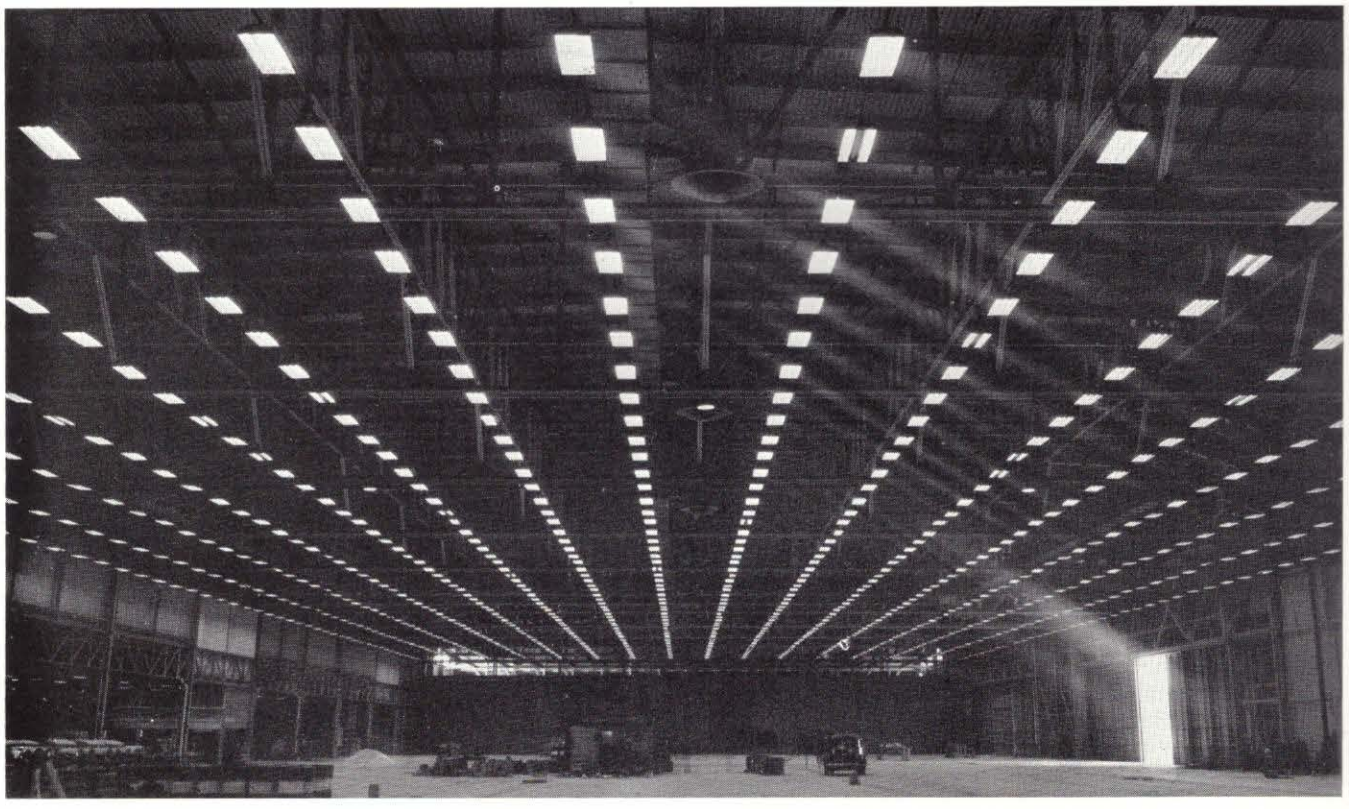
Leaflets bearing full instructions, together with payroll deduction authorization forms, were distributed with copies of Skywriter, weekly plant newspaper, the day before.

Arrangements are now well advanced to put the same arrangement into effect at North American's Dallas and Kansas City, Kansas, plants. Deductions are calculated on a monthly basis, and may not amount to less than three dollars a month.

First to sign up under the plan at the Inglewood plant was Doris M. Vance, member of the accounting department. This department, too, became the first to participate 100%.

Left, workmen of the Fisher Body division of General Motors at Memphis, Tenn., attach metal sheeting to an outboard wing flap. Right, scene on the bomber front fuselage conveyor assembly line in NAA's Inglewood plant.





Tapered by perspective, long rows of fluorescent lights mingle with reflected rays of sunlight to create an interesting pattern in this photograph of the final assembly bay of the Kansas City plant.

Kansas City Factory Is Completed in Record Time

Project Hailed One of Most Brilliant In History of Structural Engineering

One year from the date the War Department announced that three great bomber plants were to be erected in the Midwest to specifications supplied by the aviation industry, the first of these —North American Aviation's blackout bomber final assembly plant at Fairfax airport, Kansas City, Kansas —was completed.

The start of production in the new unit climaxes one of the most amazing stories in the history of structural engineering. When construction began last March, the Midwest rainy season had just started, and workmen slogged ankle deep in sticky ooze. Despite adverse working conditions, however, construction proceeded at an even pace, and the job was completed ahead of schedule.

The last word in factory construction, the plant contains the largest industrial room in the world. The entire factory is windowless, and artificially illuminated with the latest type of hermetically-sealed fluorescent lighting. Regardless of the temperature outside, it is always fair weather for employes of the North American Kansas unit—never too hot, too cold, too humid nor too dark to turn out optimum work.

Precision aircraft manufacturing demands accurate control of temperature and humidity. Too much or too little moisture in the air can upset delicate chemical processes. A finely-machined part for a modern airplane motor can be ruined by the sweat from a workman's hand.

This will never happen in the Kansas City unit, for every inch of the huge factory is air-conditioned. Chilled water is circulated in the air-conditioning system in the summer, and heat is provided during the winter by running warm water through the same battery of coils.

The entire main floor area is free for manufacturing purposes, and even the washrooms are situated on the mezzanine. Also on the mezzanine is an employes' cafeteria. Workmen on the assembly line will not have to leave the main floor to eat lunch, however, for an auxiliary serving point is situated midway between the empennage and engine departments.

Complete supervision over all watchmen is facilitated by an extensive fire alarm, signal, and intercommunication system. Telephone service extends throughout.

Frank Pieper, general foreman of the sub-assembly department at the Dallas plant, instructs Pauline Steelman, left, and Nellie Robbins in the use of a soldering iron.

Dallas Unit Finds Women Have Flair for Jobs in Sub-Assembly

The women's invasion of the Dallas factory is a success.

When Factory Manager H. F. Schwedes announced recently that employment of women in the factory would become a permanent policy, he placed the stamp of approval on a move which at the beginning was more or less an experiment. As a matter of fact, officials are so well pleased with the success of the feminine touch that they predict half of the workers in the sub-assembly department will eventually be women.

This does not mean, it was explained, that women are displacing men or that they can be used interchangeably with men for any work in the plant. It does mean, however, that in certain work, such as electric and radio wire manufacturing and instrument assembly, where great manual dexterity and patience are required, women are proving that they can do the work—in many instances better than men.

Women are being placed only in the sub-assembly department, where their talents can best be utilized. Instead of supplanting men, they are releasing male labor for other departments, to which women are not adapted, to meet the constantly expanding requirements of the defense program.

Employment of a group of 10 women early in November launched the experiment in the Dallas plant. As was true of the thousands of men who have moved into the factory to go to work during the past year, it was impossible to find feminine aircraft workers already trained. Consequently, personnel officials did the next best thing. Wherever possible, they chose women who had worked in other factories.

Officials planned at first to give the women a week of instruction before charging them with actual manufacturing duties, but so rapidly did most of them acquire the new manual skills that they were able to start on production in less than a week. Several of the first 10 were hard at work turning out airplane parts the third day after employment.

Crystal Macon is operating a small bandsaw in the Plexiglas section of the sub-assembly department.

These "charter members" of the growing contingent of Texas women airplane builders began manufacturing radio and electric wiring. Having mastered this task, several of them were moved into electrical and radio assembly, others to the instrument assembly section, still others to the jig assembly of electric wiring for installation on panels. As they graduated to the more difficult tasks in sub-assembly, others were employed to take their places.

"We have one woman here who started in after only one day of training," said Frank Pieper, general foreman of the sub-assembly department. "We had to show her only once how to perform a particular operation. Then we simply left her working at it until we were ready to teach her to do something else."

Questions Answered

When the policy of employing women in the factory was first considered, there was some conjecture as to how well men and women would work together in this particular kind of employment. Would they be self-conscious, ill at ease?

Those questions have already been happily answered at the Dallas plant.

"The first few days, the men felt the strangeness of this invasion of what had been a masculine stronghold," Pieper said. "But within a very short time, the novelty of the situation wore off, and the men had accepted them simply as fellow-workers. As for the women, each of them quite naturally was 'all eyes' for the first day or so, as is any new man who comes into the plant for the first time. By the end of the first or second day, though, she usually settled down into the routine of work, as much at home as if she were in her own kitchen."

As to apparel, officials decreed that all should wear slacks and low-heeled shoes. Later, women workers will purchase uniform slack suits. But rouge, lipstick, and finger nail polish remain indispensable. Here too, it seems, girls will be girls.

Through the Ca

"I Christen Thee..."

Above—"I christen thee Miss Greater Kansas City" were the words spoken by Mrs. Thomas Bender, wife of the first employe hired to man the final assembly line at the new Kansas City plant, as the first B-25C medium bomber assembled there was delivered as a Christmas present, all decked out in red ribbons and cellophane, to H. V. Schwalenberg, factory manager, at ceremonies Dec. 23. Honored guests were U. S. Army Engineer Corps officers.

Learni

Left—Employment of wo tions was inaugurated Jan plant when an initial co the electrical sub-assembly Brown is being initiated Charles Kruse. Women h the Dallas plant since No slack uniforms

Above—Mo wood Travel under her w of the Chri when the

Holiday Message

Right—On Dec. 24, the thousands of employes at North American's Dallas plant gathered on the flight ramp to hear a special Christmas message by President J. H. Kindelberger, carried over telephone wires from his office at Inglewood. Huge amplifiers, one of which dominates the foreground, relayed his words to the throng.

Soldiers' Christmas

Below—Troops stationed about North American's Inglewood plant were guests at a party given for them Christmas eve by employes, through the North American Welfare fund. At noon, they sat down at a festive board laden with turkey and all the traditional trimmings. Here they are receiving colorful gift packages.

Buys Stamps

Right — First purchaser of United States Defense Savings Stamps at the dedication of the Defense House in Pershing Square, Los Angeles, was Earl Meyers, member of the cowling and fairing department at the Inglewood plant. Left to right are Bob Lee, employe of the California Shipbuilding Corp., Postmaster Mary Briggs, Meyers, and one of the Defense House attendants.

mera Doors

the Ropes

*perform sub-assembly opera-
in North American's Inglewood
nt of 10 took their places in
rtment. In this picture, Betty
the mysteries of soldering by
en engaged in similar tasks at
r. All wear specially-designed
g the NAA emblem.*

Heads List

Above—First to sign up under the new payroll deduction plan for purchase of United States Savings Bonds was accounting's Doris Vance, shown here handing her authorization blank to Ray Allen of payroll.

"For She's a Jolly Good Fellow!"

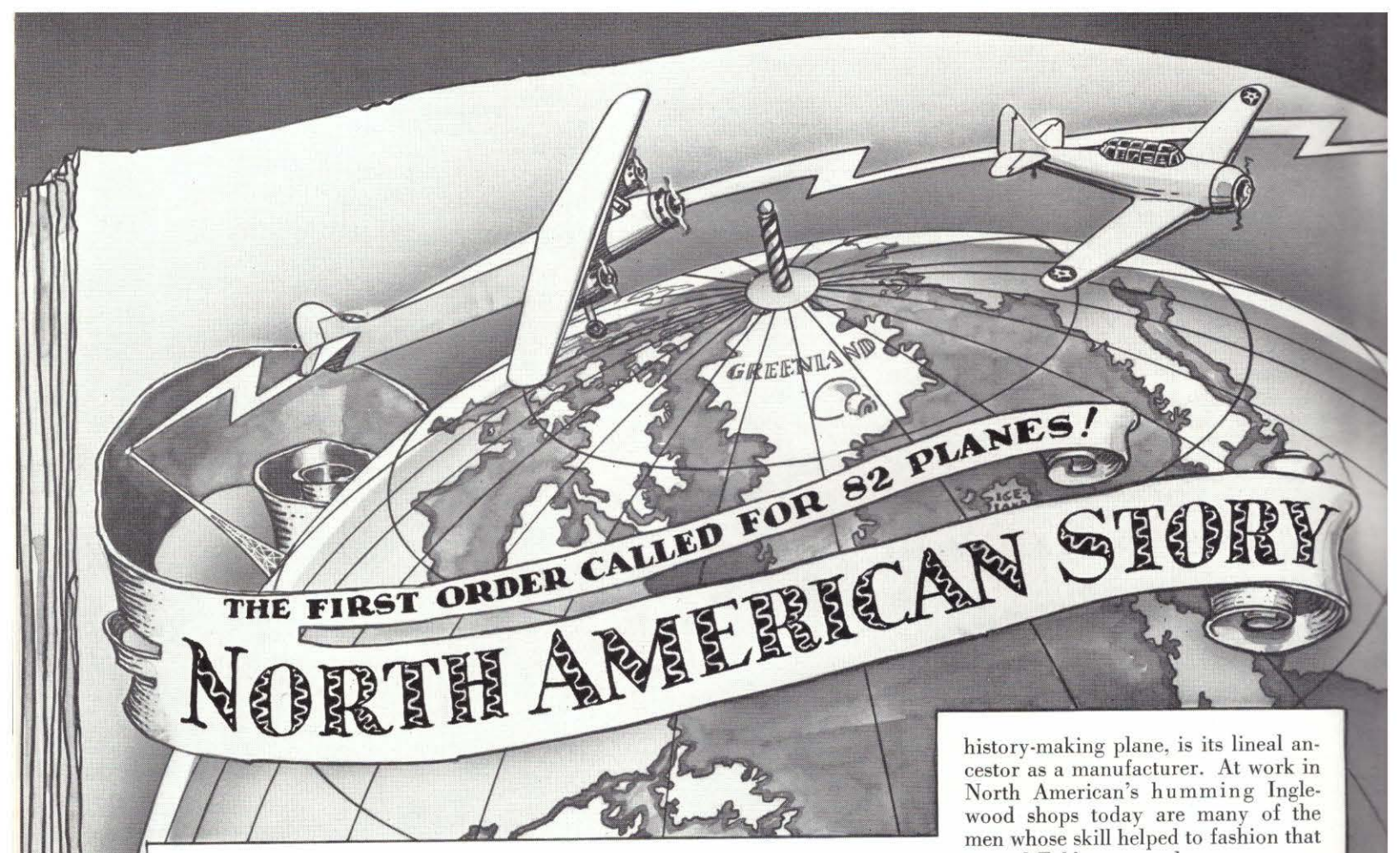
*Mrs. Frances McCarthy, head pantrywoman at the Ingle-
commissary, took the soldier boys stationed near the plant
when they visited the kitchen to "superintend" preparation
dinner given them by employes. The party was arranged
of war brought cancellation of all Christmas leaves.
was served at the mess station of each battery.*

It's War

Left—On the gray morning of Dec. 8, Inglewood employes gathered on the flight ramp to hear President Roosevelt's war message to Congress, and President J. H. Kindelberger's inspiring appeal for redoubled production.

Bomber

Right—Several hundred North American Aviation employes thronged one of the final assembly floors to see the christening of the first plane completed at the new Kansas City bomber assembly plant. Here Colonel Frank Besson of the U. S. Army Corps of Engineers congratulates the aircraft workmen on their splendid job.



THE FIRST ORDER CALLED FOR 82 PLANES!

NORTH AMERICAN STORY

ON A BLEAK morning in May, 1926, two stout-hearted men strained their gaze from the windows of a Fokker tri-motor monoplane at the ice-encrusted landscape below.

Only momentarily could they glimpse the whitened terrain through the intermittent whorls of snow, but the sight filled their hearts with triumph. Never before had any man looked down upon the top of the world!

Checking their instruments, Commander Richard E. Byrd, U.S.N., and Aviation Machinist Floyd Bennett, U.S.N., wheeled their sturdy craft around and set a course due south for Kings Bay, Spitzbergen, whence their epochal flight had started 15 hours before in the eerie light of the midnight sun.

Not by name alone is North American Aviation, Inc., a direct inheritor of the tradition of that flight. The Fokker Aircraft Corporation of America, builder of this and many another history-making plane, is its lineal ancestor as a manufacturer. At work in North American's humming Inglewood shops today are many of the men whose skill helped to fashion that rugged Fokker monoplane.

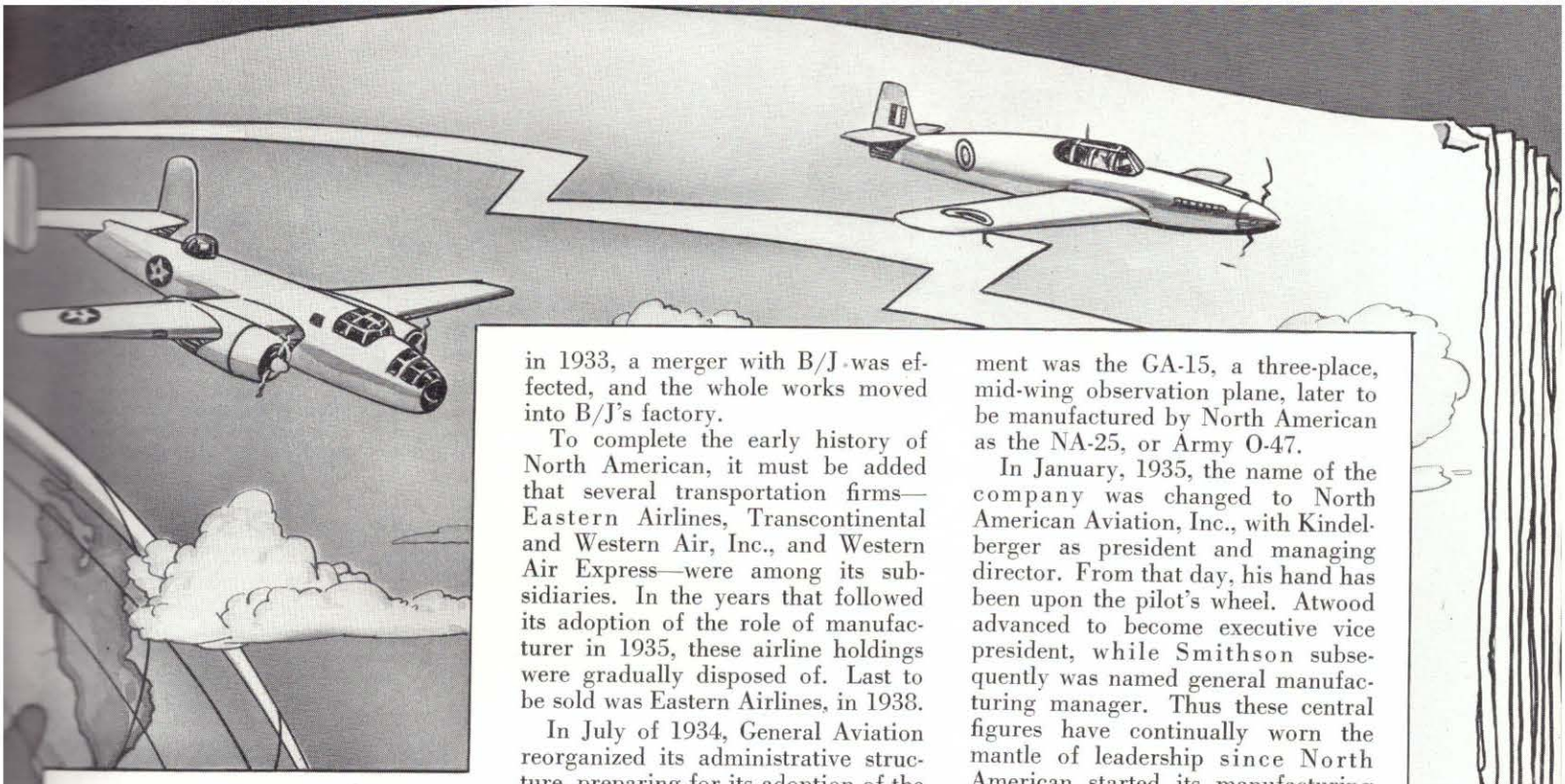
Preliminary sketches of the NA-16, progenitor of North American's famous line of training airplanes, commanded the attention of these three men as they bent over a drawing board late in 1934. Left to right are J. L. Atwood, J. H. Kindelberger, and J. S. Smithson. Scene is the old Berliner-Joyce factory in Dundalk, Maryland.

Today they are putting the knowledge born only of long experience into the building of North American's B-25 bombers and P-51 pursuits. But when a reminiscent mood overtakes them, they muse upon other ships on which they worked, such as the "Southern Cross," in which Squadron Leader Charles E. Kingsford-Smith flew 7,400 miles from Southern California to Australia in 1928; the "Friendship," in which Amelia Earhart crossed the Atlantic in the same year; or the "Question Mark," in which Capt. Ira C. Eaker set the first refueling-in-air endurance record less than a year later, and many another famous plane.

So swiftly has North American grown since its debut as a manufacturing concern in 1934 that its direct descent from illustrious and colorful pioneers in aviation is easily overlooked.

Like the crew of a seaworthy ship, a nucleus of key personnel has remained through several changes of control, and these men have preserved and communicated to their associates that loyalty and enterprise which have always inspirited the trail blazer.

In the '20's, the name of Fokker probably ranked next to that of the



Wright Brothers in popular acclaim, and even today, though less often heard, it commands a lofty height as a landmark in the chronology of aviation. From the Hasbrouck Heights, New Jersey, plant of the Fokker Aircraft Corporation which dated back to 1927, came those planes whose flights fired the imagination of the world.

In 1930, fabled Anthony Fokker sold his interests in the company to the General Motors Corporation and returned to Holland. These holdings had consisted of plants at Hasbrouck Heights, which served as manufacturing headquarters; at Wheeling, West Virginia; and at Passaic, New Jersey.

Name Changed

When General Motors acquired control, the name of the company was changed to the General Aviation Manufacturing Corporation, and soon afterward all manufacturing facilities were moved to Dundalk, Maryland, to be housed in the old Curtiss Caproni plant. Meanwhile, the firm purchased the assets of both the Pittsburgh Metal Airplane company and the American Airplane and Engine corporation.

In 1930, the Berliner-Joyce Aircraft Corporation, a small but aggressive firm located in Dundalk, Maryland, was taken under the wing of North American Aviation, Inc., which had been formed in 1928 as a holding company. When General Aviation also became part of North American in 1933, a merger with B/J was effected, and the whole works moved into B/J's factory.

To complete the early history of North American, it must be added that several transportation firms—Eastern Airlines, Transcontinental and Western Air, Inc., and Western Air Express—were among its subsidiaries. In the years that followed its adoption of the role of manufacturer in 1935, these airline holdings were gradually disposed of. Last to be sold was Eastern Airlines, in 1938.

In July of 1934, General Aviation reorganized its administrative structure, preparing for its adoption of the name North American Aviation, thenceforth to be known as a manufacturer. Looking for a man of brilliant technical attainments who also possessed the genius of leadership, the company found him in the young vice president in charge of engineering at the Douglas Aircraft company plant in Los Angeles.

J. H. "Dutch" Kindelberger accepted the offer to become president of General Aviation, although it meant leaving an important post in an established company to head an obscure firm with uncertain prospects. He took with him two key men —J. L. Atwood as chief engineer and J. S. Smithson as chief draftsman.

First ship to be designed by General Aviation under its new management was the GA-15, a three-place, mid-wing observation plane, later to be manufactured by North American as the NA-25, or Army O-47.

In January, 1935, the name of the company was changed to North American Aviation, Inc., with Kindelberger as president and managing director. From that day, his hand has been upon the pilot's wheel. Atwood advanced to become executive vice president, while Smithson subsequently was named general manufacturing manager. Thus these central figures have continually worn the mantle of leadership since North American started its manufacturing career.

First of Trainer Series

The NA-16, first plane built and designed by North American, and the prototype of North American's famous trainer series, of which more than 4,000 have been built, took off from Logan field at Dundalk for the first time in 1934, having been designed and built in less than nine weeks!

A two-place, low-wing trainer, the NA-16 then won an Army Air Corps competition at Wright field, and subsequently became the pattern for standard combat training equipment in many of the world's major air forces. Among its recommendations was inexpensive maintenance, made possible by interchangeability of parts and

Originally the factory of the Berliner-Joyce Aircraft Corporation, this plant in Dundalk, Maryland, was taken over by General Aviation following its absorption of B/J in 1933. For nearly all of 1935, it was the headquarters for North American, successor to General Aviation, until the move to the West Coast.

E.G. MICHELSON

On this page and the next are pictured some of the airplanes that have made North American famous as a manufacturer of military aircraft. Above, the GA-15, produced for the Army as the O-47.

The NA-16, first training airplane designed and built by North American, was also one of the earliest low-wing military trainers. This plane was manufactured in quantity as the BT-9.

Identified by the United States Navy as the NJ-1, this model was the first low-wing craft adopted by that branch of the service. First delivery was in July, 1937.

other design features. One of the earliest low-wing military trainers, this ship impressed United States Army Air Corps experts at Wright field as the closest approach to tactical types yet developed.

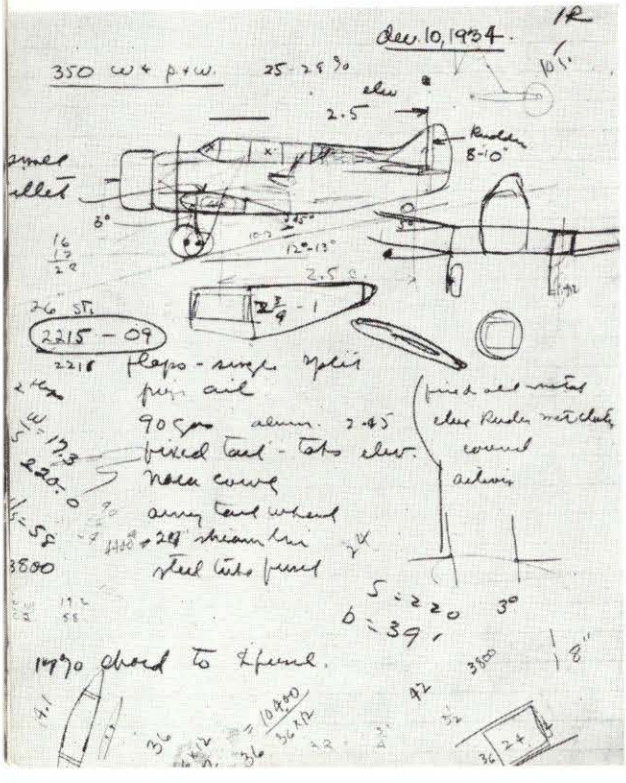
Among famous planes which have grown out of this basic design are the AT-6A advanced trainer of the United States Army Air Forces, the Harvard Trainer of the British and Canadian Royal Air Forces, and the SNJ-3 of the United States Navy, all being built by North American today.

To describe the original NA-16 design, Dutch Kindelberger coined the descriptive, "basic combat," employed in official terminology for many years. Later, however, this type came to be identified as the "advanced combat trainer."

Although a native of Wheeling, West Virginia, Dutch Kindelberger had been won over to California's climate during his nine years in Los Angeles, and when demonstration of the NA-16 brought North American its first Army Air Corps contract (in fact, its first contract of any importance) he and his associates decided to strike while the iron was hot.

Arrangements were begun at once to move the entire North American organization, lock, stock, and barrel, to the West coast. Dutch Kindelberger grins when he is asked how great a part his personal preference for California's climate played in this decision. He knows he need admit nothing, for there were plenty of other valid reasons for the move—among them a more abundant labor supply, all-year flying weather, and lower living costs.

To the uninitiated, these sketches might look like doodling, but the paper reproduced below is a historic document in the annals of North American. These drawings represent the first conception of the NA-16. Notations and drawings are by Kindelberger, Atwood, and H. R. Raynor.



82 Planes Ordered

The Army Air Corps contract called originally for 82 planes. In the light of today's astronomical production figures, an order for 82 planes hardly seems to warrant any special optimism. But this, just seven years later, is another era. In those days, annual Army contracts for 10 or 12 planes were enough to keep a company going. A yearly output of 25 planes was regarded as a spectacular performance.

Only old-timers at North American remember, however, that the very first government contract undertaken by the company did not call for airplanes at all—but for 161 sets of floats (or pontoons), designed for use on Curtiss SOC-1 scout observation planes in service with the United States Navy.

In producing the SOC-1 floats, North American established its now famous detail breakdown for production, whereby large assembly designs were systematically broken down into smaller assemblies for convenience in mass production.

The cross-continent trek took place in November, 1935. About 75 key employes made the journey, traveling by train, automobile, and even by ship via the Panama canal. Machinery was loaded onto flatcars, leaving the old brick B/J factory in Dundalk desolate as a haunted house.

A site for the new factory had been selected on the edge of the Los Angeles Municipal airport, and far-sighted plans drawn for a plant capable of methodical, integrated expansion to almost undreamed-of size. Because someone *did* dream of such growth, North American has been able to multiply the area of its parent Inglewood plant by five times in four years, smoothly and without disrupting the steady flow of production.

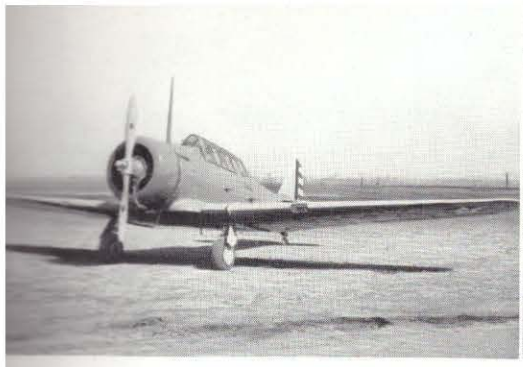
Temporary manufacturing quarters were established in the old Moreland factory adjacent to Mines field (the building just west of the present plant, since remodeled and taken over by the Interstate Aircraft and Engineering Corporation).

Meanwhile, construction began on the original Inglewood factory unit, covering 144,000 square feet of floor space. When the bright, modern building was first occupied, in January, 1936, there were 250 persons on the payroll.

Adapted for Army Air Corps use, the NA-16 was designated as the BT-9. In all, 265 of these planes were manufactured.

Under the Army designation O-47, 238 later versions of the original GA-15 were also contracted for. These planes became standard observation equipment in most units of the American air services.

North American's first contract for a basic combat type came in 1937 with completion of the NA-26 demonstrator. At this time, retractable landing gear was first incorporated in the basic NA-16 series; the Air Corps model number was BC-1, and 174



A new classification was added to Air Corps tactics when this plane was designated the BC-1 basic combat airplane. It also won enthusiastic acceptance in the export market.

Built to Air Corps requirements in 1937, the NA-21 "Dragon" bomber was North American's first venture into the twin-engine class. It was equipped with turbo-superchargers.

planes were ordered in the largest contract North American had yet received. Another department of United States military aviation began use of North American equipment with delivery of the first consignment of NA-28 trainers to the United States Navy in July, 1937. The NJ-1, as the ship was designated by the Navy, was the first low-wing type adopted by this branch of the service.

In February, 1937 — some three years before America realized it needed modern twin-engine bombers — North American completed the powerful NA-21 "Dragon" bomber, a lethal monster capable of flying 5,000 miles nonstop, and equipped with gun turrets startlingly similar to those developed in 1941 after two years of warfare. But the NA-21, like General "Billy" Mitchell, was too far ahead of its time. None was ordered.

Circular Prompts Entry

North American's next important entry into the twin-engine bombardment class came in response to an Army Air Corps circular proposal in 1938. As a result, the NA-40 was completed in March, 1939. Shortly afterwards, one of the largest contracts in Air Corps history up to that time was placed with North American for construction of a modified version of this ship, to be known in the service as the B-25 bombardment type. Produced only at Inglewood up to now, the latest version, known as the B-25C, will be assembled in record quantities at the new Kansas City plant.

Upon receipt of an Air Corps order in 1939 for BT-14 basic trainers, North American training craft for the Air Corps, in service or on order, totalled more than 500, believed to constitute a record at that time for one manufacturer. The BT-14 was still recognizable as the outgrowth of the first NA-16 trainer built in Dundalk in the summer of 1935, implying a splendid tribute to the engineering skill of the men who created the original design.

Meanwhile, North American had won for itself international renown through sale of its planes to foreign air services. The first of these transactions took place in 1935, when the original NA-16 demonstrator was fitted with a different engine and sold to the Republic of Argentina as the NA-18. Among subsequent foreign customers have been the Chinese government, the Swedish Royal Air Force, the Commonwealth Aircraft Corporation of Melbourne, Australia (which is manufacturing trainers today based on a North American design under a licensing agreement), Argentina, Venezuela, Brazil, Peru, France, Thailand, and Canada.

A prelude to the most spectacular performance of North American in the export field came in the summer of 1938, when after a tour of American aircraft plants by a commission of British experts, a contract was formally awarded the firm to supply 200 advanced combat trainers to the Royal Air Force.

This airplane was identified as the NA-16-1E "Harvard" trainer, in accordance with the British practice of naming training planes after schools.

From top to bottom: The NA-16-1E "Harvard" advanced combat trainer, built in quantity for the British and Canadian Royal Air Forces since 1938; the NA-44 light attack bomber, completed in July, 1938, a new type for North American; the NA-35 primary trainer, equipped with a Menasco engine, the first in-line type produced by the company; and the NA-40 twin-engine bomber, from which the B-25's of today were developed.

At right, members of the General Aviation engineering department posed before the YO-47 they helped build in 1932. Members of this group with North American today are John Young, Frank Sigafoose, Newton Houston, Edgar Schmued, Charles Koenig, Vic Johnson, Noble Shropshire, and H. R. Raynor.

North American maintained its reputation for speed by completely redesigning the Air Corps trainer to meet British requirements as the Harvard, and getting the first plane crated, through the Panama canal, across the Atlantic, uncrated, and test flown in England only 120 days after design work started. That achievement becomes meaningful when one realizes that 990 of the original 2,200 design drawings required changes to produce the Harvard design. Bettering all previous production records, North American fulfilled the contract in 11 months, and meantime, a repeat order came through. The company has been in continuous production of this model ever since for both the British and Canadian Royal Air Forces.

During 1940, under the gathering impetus of the national defense program, North American forged ahead to new production records. Possessing an advantage over aircraft companies forced by the turn of events to enter a new and strange field, the firm was able to draw upon its wealth of experience as a manufacturer of military aircraft exclusively, to meet new and unprecedented demands in short order.

The production effort was concentrated thenceforth on three basic types—the B-25 twin engine medium bomber, the AT-6A advanced trainer (descendant of the old NA-16), and a sensationally-fast Allison-powered pursuit plane.

AT-6A's ordered under the national defense program were flying daily to advanced training centers of the Air Corps as early as September of 1940, although the contract for the type was signed by the War Department only 40 days before the first ship was completed. This unusual performance was possible because North American began production on its own responsibility to expedite the nation's air training program.

Developed in 1940, the new pursuit ship, designed originally for the British Royal Air Force, which dubbed it the "Mustang," appeared on the basis of secret tests to be the fastest fighter in the world. One hundred days after the preliminary design sketches were begun, the preliminary airplane was completed. And in one-half or one-third the time normally required, the new plane had been completely built, tested, and accepted by the R. A. F., thereby releasing long assembly lines already formed. The Mustang is now being produced in quantity at the Inglewood plant, and with a few minor design changes is going also to the United States Army Air Forces as the P-51.

Construction of the Dallas, Texas, factory was determined upon in the summer of 1940, when it was decided that space then available at Inglewood could not meet the demand for advanced trainers along with the new bombers and fighters required of North American. Building operations began in September, 1940, and production was under way seven months later. Operated as a division of North American, the Texas plant is devoted exclusively to trainer production. In August, 1941, the last advanced trainer built at Inglewood rolled out of the factory doors, and this assignment was completely taken over by the Texas plant.

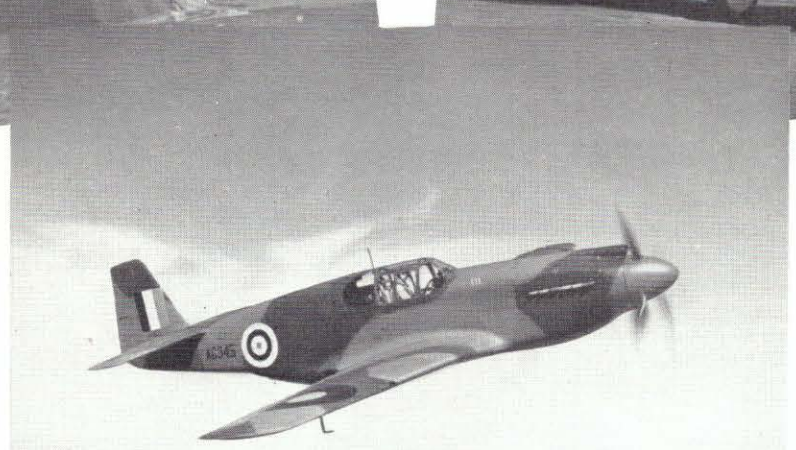
Ground for the bomber assembly plant now in production at Kansas City was broken in March, 1941. Plans called for a floor area slightly larger than that of either the Inglewood or Dallas plants. The Kansas City plant is being operated by North American for the United States government.

With this, the dramatic chronicle of North American as a manufacturing organization arrives at the present day. Lashed on by the fortunes of war, airplane production now is a far cry from the hit-or-miss system of the early days, when every man in the factory would knock off to watch the test flight of a new ship, when nearly every plane was a custom-built model, and when the financial groundwork of this adventurous industry was so insecure that payday meant a race to reach the bank before the funds ran out . . .

The uncertainty and some of the romance of aircraft fabrication have perished, it is true, under the stress of high-speed assembly methods. But the spirit of loyalty and enthusiasm handed down by those pioneers of the industry to whom their work was a religion continues to inspire the team that is North American Aviation.

North American's modern Inglewood plant was a month old when the photograph at the left was taken, in February, 1936. Below is the view from the same vantage-point today.

Above, left—Complete to the British Royal Air Force insignia and tail stripes, a Harvard combat trainer leaves the Inglewood plant for Canadian training centers. Above, right—An SNJ-3 Navy scout trainer gets an engine warm-up on the flight ramp. Right—Ready to take on all comers is this camouflaged Mustang fighter, built by North American for the British Royal Air Force.



CURRENT MODELS

PHOTO BY U. S. ARMY AIR CORPS

Above—During test flights, North American B-25 medium bombers often fly hundreds of miles from the Inglewood factory. Here one of the sturdy warplanes wings over the Pacific ocean, just off the California shore. Right—Dressed in the drab olive-green war coat of the United States Army Air Corps, a B-25B soars over the rugged terrain bordering Big Bear lake in the San Bernardino mountains. A later version than the ship pictured at left, above, the B-25B has upper and lower gun turrets.

Above—North American AT-6A advanced trainers, now being built at the Dallas, Texas, unit, are standard equipment at most Army training bases. Student pilots of the Southeast Training Corps area at Maxwell field, Alabama, receive advanced training in the trim ships. The AT-6A is a direct descendant of the original North American BT-9.

Dallas Makes Mass Delivery at Eight-Month Mark

Fifty Advanced Trainers Flown Away By Pilots for Navy, Army Air Forces

Just before the mass delivery on Nov. 22, 1941, the Dallas flight ramp presented this picture.

"The Dallas Story" is one of the important chapters in the continuing production achievement which has come to be known as "The North American Way."

This chapter opened early in the summer of 1940, when North American's management began inspecting sites for a new factory.

It reached a spectacular crest on November 22, 1941, when North American's Dallas factory, in production eight months, made its largest mass delivery—50 AT-6A's and SNJ-3's for the Air Corps and the U. S. Naval Air Service, respectively, marking the first anniversary of the date on which the first structural steel was unloaded at the muddy site of the new plant.

When Army and Navy ferry pilots took the 50 airplanes into the cold November sky, North American's Dallas plant had made good on a promise to the United States of America that a certain number of planes would be produced by the new factory within a year from the day construction started. That promise had been regarded by many, including experts in the military and naval air services and in the aircraft industry, as extremely optimistic. But North American's Dallas plant made good—with some planes to spare.

"The Dallas Story" has literally telescoped time. Early in 1940, North American's management recognized that the rapidly expanding national defense program would make greater demands upon the aircraft industry than existing facilities could meet. They began a careful inspection of sites for a new North American factory.

It was decided that the Dallas plant should be a complete manufacturing unit, designed for production without frills. The engineering, experimental, and other contributing departments which are normally adjuncts of an aircraft factory, were already set up in the parent factory at Inglewood, so they were omitted from the Dallas plans.

It was decided, too, that the entire plant should be on one floor level. Plans called for a blackout plant, with fluorescent lighting and air-conditioning, to provide constant light and temperature day and night, the year round. It was decided that the plant should be designed for directional flow of production, to make possible maximum efficiency, eliminating "backtracking" and duplicated effort.

Construction contracts were awarded November 6, 1940. The James Stewart Company, contractors, started grading on the 150-acre site November 13, and poured the first concrete foundations November 16. The first shipment of structural steel arrived on the site November 22, 1940, and on March 8, 1941, manufacturing operations began in the still-incomplete factory. By April 7, when America observed 1941 Army

Day and the plant was dedicated, three AT-6A's, built in Texas by Texans, were ready for delivery to the U. S. Army Air Corps. The planes were accepted by Major General George H. Brett, Chief of the Air Corps, and the principal address at the dedication was made by William S. Knudsen, Director General of the Office of Production Management.

When those first three AT-6A's were flown away April 7, the Texas family's feeling of elation was tempered by a realization of the tremendous production responsibility which lay ahead. The new plant was separated from the parent factory by more than 1,600 miles of plains and deserts and mountains. And the job cut out for it called for production—right from the start.

It was at this point that the company developed a vitally important phase of the North American way of teamwork to "get 'em built." The parent factory at Inglewood undertook to provide the infant Dallas plant with complete sets of detailed parts for a certain number of airplanes. In this way, the Dallas factory was enabled to get its sub-assembly and final assembly departments functioning, turning out finished airplanes in rapidly increasing numbers. In the meantime, the new plant got all its own detailed manufacturing operations under way.

On September 1, 1941—the exact date fixed months before for the termination of this teamwork arrangement between Inglewood and Dallas—the new factory completed the number of ships for which the parent plant had provided detailed parts. Since that date, Dallas has been entirely on its own, insofar as any detailed manufacturing aid from Inglewood is concerned. Built as a complete manufacturing unit, from die foundry to final assembly line, it is now functioning in every department at a constantly increasing tempo.

Bob Cochran, boot-clad ex-Californian, here betrays his alienated affections by clambering perilously aloft to hang up the Lone Star flag of the State of Texas in North American's Dallas plant.

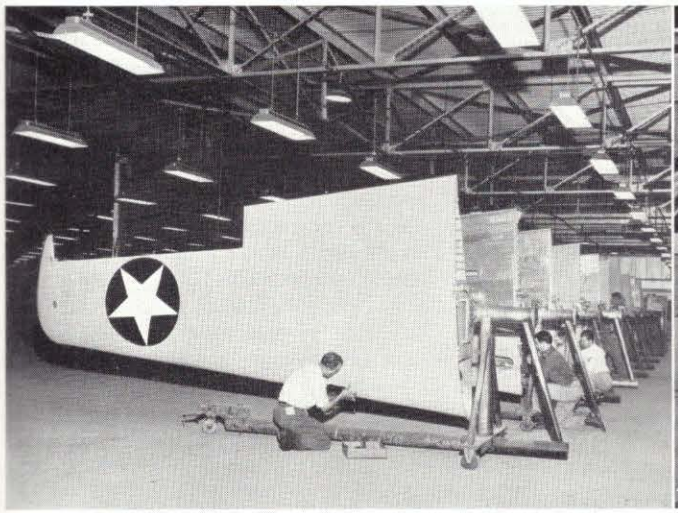
In this respect, "The Dallas Story" has provided a pattern for the teamwork which was later to be used by North American and the General Motors units of the automotive industry in getting production under way at the new Kansas City bomber assembly plant.

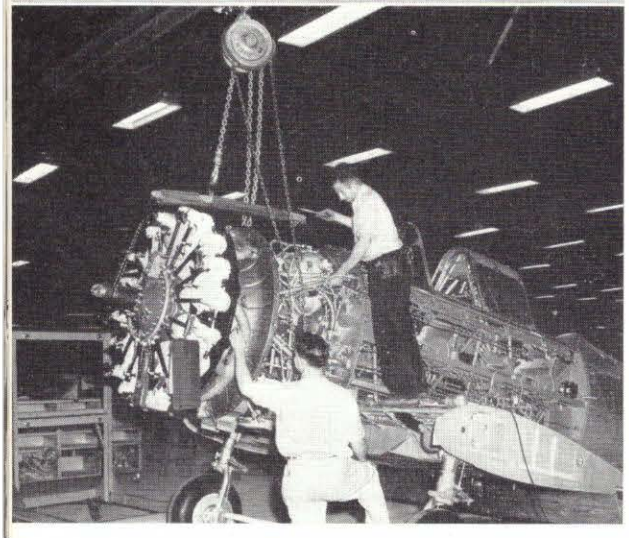
The parent factory at Inglewood represented the most recent advances of the industry when its first unit was completed in January, 1936. But that first unit became the nucleus, around which five years of almost continuous, amoeba-like expansion has taken place. The designers were able to embody in the new Dallas factory all that Inglewood had learned in five years of constant expansion, plus everything that could be gleaned from the experiences of the entire aircraft industry.

A major factor in the success of "The Dallas Story" has been the adaptability of Texas labor to aircraft manufacture. When North American selected the site for its Dallas factory, it was pioneering. There were no other large industries of its kind in the Southwest. In an area where there was no great reserve of skilled labor, North American was proposing to establish a factory which within a year would be employing thousands of persons.

Events and production records have justified North American's willingness to pioneer. Experience has shown that Texans are well adapted to aircraft manufacture, and that once they know enough about a job in the factory to feel confidence in themselves, they can equal or better the produc-

Lower left, a lineup of rotary wing jigs in the Dallas plant's outer wing final assembly department. Finished outer wing panels stand upright in racks awaiting installation. At right, a scene on the final assembly floor just a year after first structural steel had arrived for the building.





At top, gasoline tanks for many an advanced trainer being moved up to center section sub-assembly.

Center, Texans at work in the Dallas plant's fabric covering department.

Bottom, final assembly line workmen make last connections after the power plant has been attached to the fuselage.

tion estimates made for them. "The Dallas Story" is a record of Texas youths who have come to the North American plant equipped primarily with a high native intelligence, with a mechanical aptitude acquired from work on farms or ranches where everyone must be able to repair the tractor or get a windmill working again, and with an unquenchable enthusiasm for aviation.

President J. H. Kindelberger summarized "The Dallas Story" the night of November 22, 1941, when he told a dinner meeting of foremen and department heads of the Texas organization:

"You have made aviation history.

" 'The Dallas Story' is one of production achievement, a bright chapter in the entire national defense effort. This gang has done a swell job. A year ago, we promised that a certain number of airplanes would be built in this factory a year after construction had started. You've made good on that promise—with a margin for good measure. We can't say how many planes have been built, because that is a military secret. But it is more than enough to make this stand out as one of the grand shows of the entire aircraft industry."

Supervisory Talent Rises From Ranks

The problem of obtaining capable supervision for a personnel which in little more than a year jumped from 33 to several thousand has been happily solved, in part, by members of that very personnel at the Dallas NAA plant.

As a matter of fact, most of the foremen and other overseers in the plant have been promoted to their present positions since coming to work for North American.

A case in point is that of a young man who several months ago obtained a job in the shipping department at the Dallas plant. He had never been inside an airplane factory before. After a short time, he decided he would like to work more directly with airplanes, and obtained a transfer to flight test. There he moved up rapidly to become one of the two crew chiefs.

Education Section Promotes Training

To help meet the demand for skilled workmen, and at the same time aid employes seeking advancement to positions of greater responsibility and better pay, a three-fold program is being carried on by the Education section of North American's Inglewood plant.

One phase of the program is concerned with encouraging pre-employment training of persons with mechanical aptitude, to fit them for jobs in the aircraft industry; another provides instruction for persons already employed, to heighten their skill and qualify them for promotions; and the third provides for conferences to assist in solving problems faced by supervisory personnel.

In charge of the program is John H. Fry, head of the Education section, who represents the company on both the Los Angeles Aircraft Advisory board and the National Defense Advisory committees of local school districts.

Miles of 'Times' Describes Thrill of Ride in Bomber

Readers of the Los Angeles *Times* vicariously experienced the sensation of streaking along in a B-25 medium bomber one Sunday morning last month when they read a dramatic account of such a flight, prepared by Marvin Miles, *Times* staff writer.

By special authorization of the War Department, Miles went along as an observer on the final factory test flight of a B-25, with George Armistead, North American test pilot, at the controls, just a few days before the United States went to war.

In colorful language, the journalist related every thrill that might be felt by anyone unused to the power and speed of a first-line military airplane. Miles' article was liberally illustrated with photographs, one of which showed him seated in the B-25 gun turret.

SKYLINE SILHOUETTES

Ask an old-timer in aviation if he remembers the days when Lincoln Beechy used to fly his bamboo-and-wire airplane around over the fair grounds racing Barney Oldfield in his car. Ask him about Silas Cristofferson, the old-time cross-country racing pilot. It might seem as if the only person able to answer those questions would be one of the Wright brothers' helpers at Kitty Hawk. Yet Roy Bodeen knows the answers, though he wasn't old enough to enlist in World War I.

He has crammed a lot of aviation into his life since the day he enlisted at Mather field, California, back in 1919. He got his wings at Kelly field, San Antonio, in the second class to finish after the signing of the Armistice, and immediately took part in the bombing maneuvers at Langley field, where General "Billy" Mitchell made history. Up to a few weeks ago, Roy held his reserve commission in the Air Corps after serving his hitch flying the big 'uns.

North American put in a bid for Bodeen in 1938 and shipped him over to France to help uncrate and test the 57 and 64 trainers ordered for the Tricolor air force. Part of his work was done in colorful Casa Blanca, French

Roy Bodeen: "Fly sanely and you'll fly safely."

Morocco, where again his task was flying the newly constructed trainers before delivering them to French fliers.

Back in Paris, news of the Nazi advance caused the Bodeens to pack their bags and start for the nearest port. They managed to get tickets for the last liner to leave Marseilles for the United States.

In April, 1941, NAA sent Bodeen to the new factory at Dallas, where AT-6A's and SNJ-3's were just beginning to take shape. Roy was given the job of flying these Texas-made products before acceptance by the Army and Navy resident inspectors. Now, as chief test pilot, he has two pilots and a score of ground crew men to carry on the ever-growing job.

More than 3,000 hours are in Roy's log book. He has

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Novelists tell us that every man's life would provide material for a good book.

Nor is the personal history of Ralph H. Ruud, general superintendent of North American's Inglewood plant, an exception, for he has an interesting story to tell.

At first blush, Ruud looks like what he is—a young executive. Big and blond, he gives the impression of physical strength and unbounded energy. In his early thirties, he suggests an ex-football tackle who would still be a good man to have on your side when bucking the line.

"Leave the door open," he said as we entered his office. "It's cooler that way." We noticed that it was also easier for information-seekers to gain admittance, for during the half-hour interview there were frequent interruptions.

Noting his size, we asked if he had played football. "Not that. Swimming's my sport," he replied, and told of winning a ten-mile race across Barnegette Bay on the mid-Atlantic coast when he was fourteen. "I only swim for recreation now," he laughed, patting his stomach, "although I could stand to do it a bit more often."

Since Ruud is a Scandinavian by birth, we wondered if he excelled at winter sports. "I'm no expert at them," he said. "The last time I skied I broke my collarbone. That was twenty-two years ago." He good-naturedly admits that he has been playing golf for 14 years and is still trying to break 90.

Ruud drives a '41 Olds club coupe, and admits that he has never changed a tire on it, nor would he unless absolutely necessary. Yet the faintest rattle sends him hustling into old clothes, so he can crawl underneath to see what is wrong. "I'm a sucker for engines," he confesses.

Rickey, his four-year-old son, looks and acts like Ralph, and is the apple of his eye. Already as big as a boy of seven, the youngster is going to be a football player, if his Dad has anything to say about it.

Ruud was born in Oslo, Norway, 33 years ago, and

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Ralph Ruud: "I'm a sucker for engines."

chemists call it Poly-methylmethacrylate

BUT IT'S "PLEXIGLAS" TO EVERYONE ELSE

TUCKED away in a corner of the mezzanine floor of the Inglewood plant, overlooking the bomber final assembly bay where rivet gun, electric drill, and air hose mingle their strident songs, is the enclosures department.

It is here that a crew of 16 men ply their skill in fashioning sheets of crystal-clear Plexiglas and Lucite into windows of sparkling transparency for B-25 bombers and Mustang pursuits.

Plexiglas and Lucite are trade names for a plastic with the fancy chemical handle of poly-methylmethacrylate. For convenience, both Lucite and Plexiglas will hereafter be referred to as the latter, although both are used extensively in North American aircraft.

Advantages of this substance are legion. It can withstand tremendous variances of temperature, and no natural heat or cold causes discoloration. Its weight is less than half that of glass, yet it will not shatter. Extremely ductile, Plexiglas can be bent in two- and three-dimensional curves to lie snugly on faired airplane surfaces.

Exactly 9,208 square inches of this glass-like material are used on the B-25 alone. With the exception of the pilot's side windows, windshield, and bomb glass areas—which are made of a tough, tensile material called vinal, sandwiched between sheets of eighth-inch plate glass—all visual surfaces are Plexiglas.

There is little choice between plate glass and plastic glass as to transparency. Plate glass proves more satisfactory for some areas, since Plexiglas is relatively soft and scratches easily.

Actual forming of plastic cabin enclosures begins with rough cutting of flat cast Plexiglas sheets according to template lines. The covering of adhesive paper, which protects the sheets from scratching during shipping from manufacturer to the Inglewood plant, is stripped off and the Plexiglas is ready for forming.

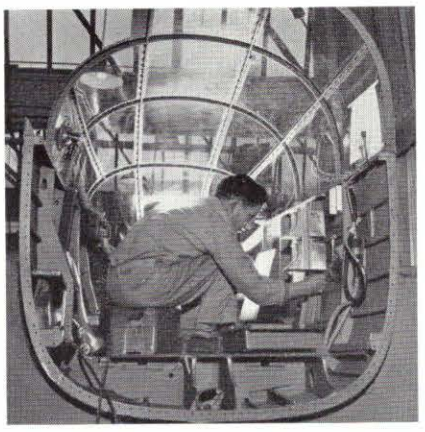
Heat comes first. The cast sheet is hung vertically in a hot-air oven and baked at a temperature of 250 F. for about 10 minutes. When taken out, it is soft and pliant. The heated sheet is then placed over a plaster die pattern on a forming block, and pressed to the desired contour. Care must be taken throughout the entire bending operation to prevent the heated material from touching rough surfaces or picking up dirt particles.

"There's no time for dallying on this job," observes Fred W. Judson, youthful foreman of plastics. "The

After a Plexiglas bomber tail cone has been removed from the press, it is carefully inspected for flaws and distortion. At left, Fred Lutes examines a newly-pressed section before trimming the edges to template lines.

Ben Andrist carefully lays a warm sheet of Plexiglas in the mould for pressing.

Trimming the plastic tail cone on a high-speed band saw is Lloyd Ingison.



William Rogers inspects the Plexiglas installation in the B-25 nose section.

boys have about 10 seconds to transfer the material from oven to block before it cools and is unworkable." Since the warm Plexiglas surface readily takes impressions, it must not be touched with the bare fingers but is handled with clean cotton gloves.

Both the lower and upper halves of the die are cushioned with two thicknesses of outing flannel. Thirty-seven different plaster die patterns are used in forming two- and three-dimensional sections for the bomber alone. Mustang plastic surfaces require seven different moulds.

After the cast sheet has remained in the press three minutes under 75 pounds pressure per square inch, it is removed. No longer a flat sheet, the material has adopted the contour of the die and is now an airplane part. A protective cover of paper is placed over it to guard against surface scratching. Adhesive strips hold the "jacket" in place, leaving the edges exposed.

Next step is to trim the part to exact template size on a high-speed band saw. This done, the edges are leveled on a rotary grinder. Then they are routed and smoothed with a burnishing tool, so that the part can be installed flush with the airplane skin.

Anchor screw holes are then drilled along the routed edges. Ordinary drills for metal may be used if care is taken to avoid "grabbing" when the drill penetrates the surface. The operator must not exert too much pressure, for friction heat will soften the material. Oil or water coolants can be used to prevent this.

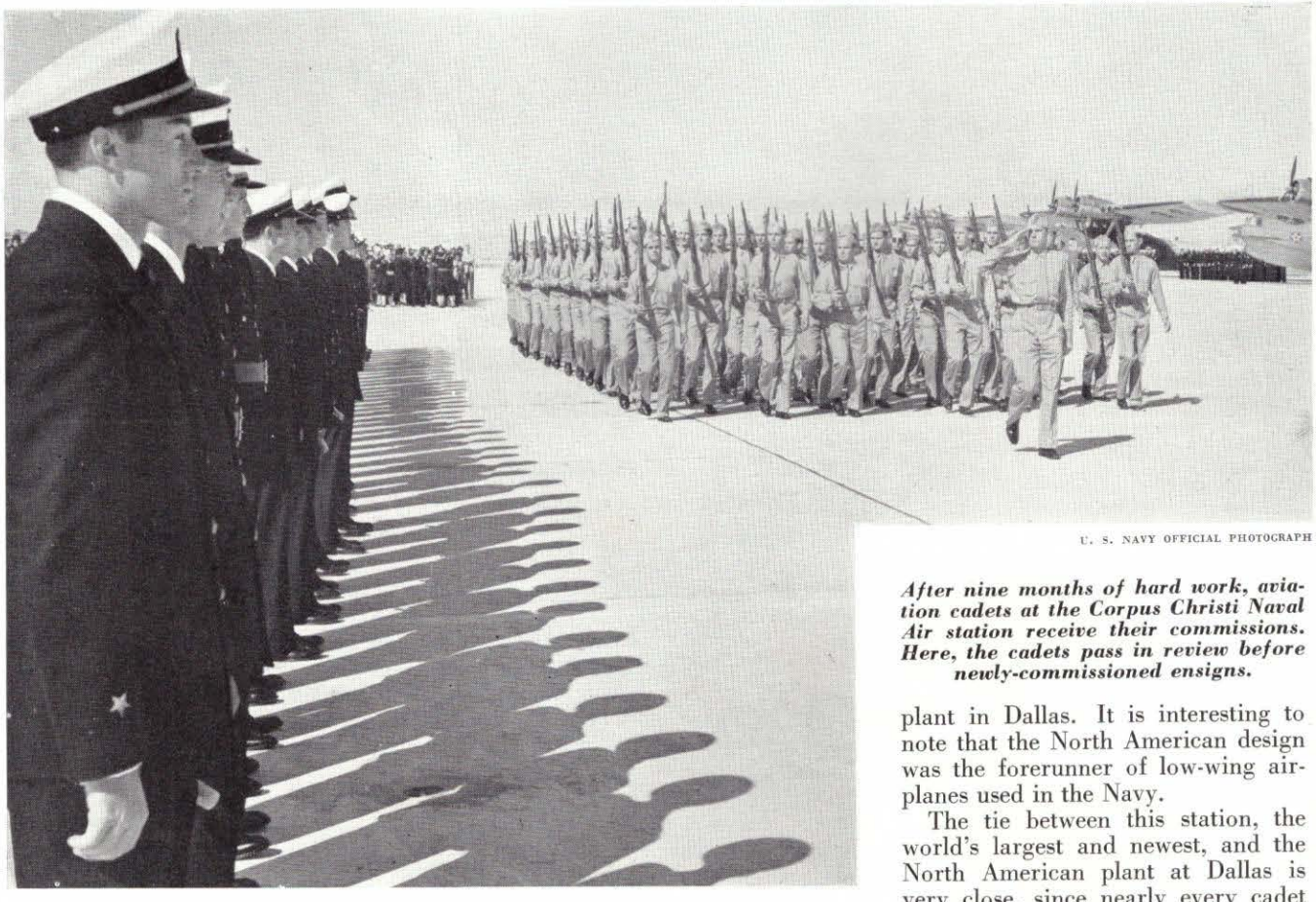
Nevertheless, surface scratches occasionally occur, and in this event, the material is rubbed with an extremely fine abrasive, known as Tripoli, and polished on a linen buffer.

This is no job for a novice, for the technique of the operator is as important a factor as equipment and polishing compounds. Caution is necessary to avoid excessive pressure in one spot, for the friction will develop heat. A paste of water and pumice is sometimes used in this process.

The part is now ready for cleaning. Here again, infinite care must be observed. To avoid scratching, the part must be washed with a grit-free, soft cloth, chamois skin, or sponge. Rubbing with dry cloth is unsatisfactory, since this builds up an electrostatic charge which attracts dust particles from the air. Should this happen, rubbing with a damp chamois skin will release the charge as well as remove the dust.

Kerosene, naphtha, or common soap may be used to remove grease and oil smudges, but acetone, benzine, and similar strong cleaning solutions will scar the sensitive surface. After cleaning, the part is again wrapped in its protective covering, and is then ready for installation on the airplane.

"Admiral Tuggle says he's here to inspect the sub-assembly."



U. S. NAVY OFFICIAL PHOTOGRAPH

After nine months of hard work, aviation cadets at the Corpus Christi Naval Air station receive their commissions. Here, the cadets pass in review before newly-commissioned ensigns.

North American Trainers Equip Corpus Christi Naval Air Base

By Lt. C. C. McCauley
Aide to the Commanding Officer
U. S. Naval Air Station, Corpus Christi

Plans for building a Naval air station on the Texas Gulf coast were initiated two years ago when Admiral A. J. Hepburn and a board of high-ranking Naval officials were ordered to investigate and report upon the need for the establishment of additional submarine, destroyer, mine, and Naval air bases on the coasts of the United States, its territories, and possessions, in the interest of national defense.

Late in December, 1938, Admiral Hepburn recommended that the output of fliers be doubled, and this required another major training station. A station on the shores of the Gulf Coast was thought to be the best, due to year-round flying conditions. The selection was made near Corpus Christi, at Flour Bluff.

The first appropriation made by Congress for the construction of this station was $25,000,000. Shortly thereafter, $15,000,000 was added, and only a few weeks ago, another $8,700,000 was appropriated, bringing the total cost to approximately $50,000,000.

At the Naval air station, Corpus Christi, one will find the sky dotted with sleek, silver North American planes, recent deliveries from both the West Coast and new North American plant in Dallas. It is interesting to note that the North American design was the forerunner of low-wing airplanes used in the Navy.

The tie between this station, the world's largest and newest, and the North American plant at Dallas is very close, since nearly every cadet who completes a successful course has spent many hours of intermediate training—an important phase—in North American models designated by the Navy as SNJ's.

The Navy gained title to the land comprising the main station on July 6, 1940, and started actual construction the latter part of the month. More than 17,000 carloads of material have arrived, and construction is not yet complete. This includes 650,000 tons of steel and building material which have gone into the construction of more than 400 buildings, paved highways, and hard-surfaced landing fields.

Pavement in the main field alone represents more than 80 miles of highway. Nine thousand workmen have been engaged in this project at one time. The remarkable fact concerning this base is that construction is a year ahead of schedule, and training 13 months ahead. The station was commissioned March 12, 1941, and the first class of cadets arrived March 15.

Of this first class of 50, 45 received their wings of gold and commissions in the United States Naval Reserve from Captain A. D. Bernhard, Commanding Officer, on Nov. 1, 1941, setting a record for air training never approached before. Today these cadets are moving out to join the first line of defense as skillful fliers of every type of plane used by the Navy.

These young men will be followed by a steady stream of cadets at an average of 10 a day, or 300 per month. By the end of last November, there were more than 2,000 students in training under approximately 650 instructors. The University of the Air is the only training school where a cadet may pursue a rounded-out

U. S. NAVY OFFICIAL PHOTOGRAPH

John A. March, aviation cadet at Corpus Christi, is climbing into a North American SNJ-3, ready for a spin.

course of flying—primary, intermediate, and advanced—under a single command at one place.

At Corpus Christi, cadets become skilled in flying not only trainers, but torpedo planes, scout bombers, scout cruisers, battleship observation craft, patrol planes, and the deadly little fighters. They are trained to throw a dive bomber into a vertical dive from thousands of feet at a terrific speed and let go their lethal parcels.

The United States Navy first perfected dive bombing tactics now used with such devastating results in Europe. Nowhere are there fliers better qualified for this particular job than those in Uncle Sam's own Naval Air Service.

The present course of training at Corpus Christi has been stepped up so that the station is averaging more than 40,000 flying hours per month, and plans indicate that this figure will be materially increased in the near future.

North American employes may reflect with pride upon the fact that their planes are helping to accomplish a great mission; that of furnishing planes for the training of pilots at the world's largest Naval air station so that it may discharge its responsibility in the finest traditions of the Navy—which means the finest traditions in the world.

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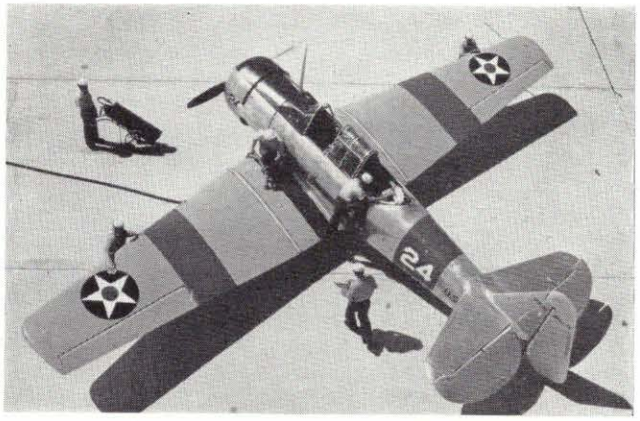
This unusual photograph shows a North American SNJ-3 advanced trainer being serviced at Corpus Christi preparatory to a flight. The NJ-1, first plane supplied by North American to the United States Navy, was also the first low-wing type adopted by the service.



U. S. NAVY OFFICIAL PHOTOGRAPH

Ruud . . .

(From Page 31)

when he was 10 years old the family emigrated to this country, settling in Springfield, Mass. Later, at Lavallette, N. J., young Ruud entered the fifth grade without knowing a word of English. By the time he was ready for high school, the family was living in Philadelphia, where Ralph served his apprenticeship in machine shop and tool making with a recording instrument manufacturing company. He studied electrical engineering in night school.

Jobs with General Electric and Automatic Utilities followed, and he was foreman of the service room at the latter when he quit to join the Air Corps. Lindbergh's Atlantic hop shortly before had stirred up such interest in aviation that the Air Corps had more applicants than it could take care of and had to hike its educational requirements.

Discovering that his formal schooling was inadequate, Ruud enlisted as a mechanic. After a year of this, he "bought himself out" and went back to Automatic Utilities.

But aviation was in his blood, so he went to work for Metallurgical Laboratories, Inc., which did sub-contractual jobs for Berliner-Joyce. In 1931, he switched to B/J, where he subsequently worked in welding, tool design, inspection, tool making, experimental, and sheet metal departments.

He made the move to Inglewood with North American in 1935, along with a number of other key employes. There he started the tool design department. The jig department later grew out of tool design, and for a time he was chief tool designer and foreman of the jig department.

In 1940, Ruud was appointed assistant superintendent in charge of machine divisions in the Inglewood plant. Early in 1941, he was named superintendent of all sheet metal work, and last August took over his present post as general factory superintendent.

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Bodeen . . .

(From Page 31)

had only one crack-up — during his early student days. His policy is just to "fly sanely and you'll fly safely."

Texas has crept into the Bodeen bloodstream. The friendly, fast moving test pilot has settled down for awhile and built a home near Dallas. Near an airport, of course. The drone of airliners shuttling in and out of Love field, Dallas' commercial air terminal, can be heard at the Bodeen household day or night. He modestly points out that his new home is directly on the radio beam between Love field and Meacham field, Fort Worth. And thus, literally as well as figuratively, Roy is "on the beam."

"Wirraway" Is The Word For "Challenger"

NA-33 Was Prototype of All-Purpose Planes Produced by Australian Plant

LATE last October, Australian Minister for Air Arthur Drakeford announced that the Royal Australian Air Force possessed numerical strength greater than that of the R.A.F. before the war expansion program. Personnel of the R.A.A.F., he said, stood at 60,000, representing nearly a 20-fold growth since Australia declared war. This indicates that some remarkable things in aviation have been going on 7,000 miles away —"down under" in the South Pacific.

In 1937, Australia, with a population of 7,000,000 in a continent the size of the United States, had virtually no aircraft industry, and no resources of plant equipment or technical background such as stem from an automobile industry.

Somehow, Australia had to create an aircraft industry as a vital necessity of national defense. Defense added up to one big thing—an air force, which then had a personnel totaling about 3,000. The country had always been air-minded since Australian Lawrence Hargrave in 1890 built the rotary airplane engine and box kite that developed into the Farnum biplane. It was air-minded during the great England-Australia flights of the '20's, beginning with Ross Smith's and culminating in the $50,000 London-Melbourne Centenary air race. It was air-minded when Charles Kingsford-Smith and Captain P. G. Taylor pioneered trans-Pacific flight. But it had no aircraft industry.

Looking around, the Commonwealth Government found the man who might create one. He was Wing Commander Lawrence J. Wackett, a World war ace, said to be the first man to fit armor plate to a warplane and the first to parachute ammunition to front line troops.

Since the war, Wackett had operated an aeronautical research laboratory in Sydney, designed a series of military planes, including two amphibians (one a locally famous type, the Wackett Widgeon), and in general behaved like a one-man aircraft industry.

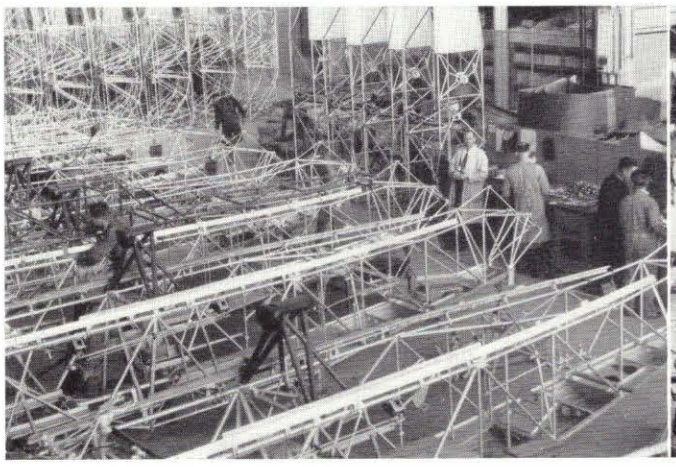
With government backing and a promised contract for 40 planes, the Commonwealth Aircraft corporation was formed with Wackett as manager. First step was a tour by Wackett and a technical group through the aircraft factories of Britain, Europe, and America. Wackett was looking for a plane with no "bugs" —something that a brand new industry could build—and something that would stand the wear in the race of design. It was not until he arrived at Inglewood, California, that he found what he was looking for.

It was the NA-33, and it looked like what the doctor had ordered. Wackett liked the plane and he liked the way it was being built. He liked the Pratt and Whitney Wasps that powered it and had a hunch they would prove stout work-horses for a young industry. In J. H. (Dutch) Kindelberger, North American's president, he found someone who talked his language—production language with an airman's background.

Commonwealth Aircraft acquired the right to build both NA-33's and the Wasps under license. Wackett decided to build both under the same roof, and late in 1937 opened his plant on a few acres of sandy waste called Fishermen's Bend, Port Melbourne.

Wackett's group at Commonwealth had virtually to conduct a school be-

Starting almost from scratch, under pressure of war Australia has succeeded in establishing an aircraft industry on a mass production basis. It took Commonwealth 16 months to produce the first hundred Wirraways, but the second hundred rolled out in three and one-half months. At left, finished fuselage frames ready for the assembly line. Right, Wirraways lined up for installation of electrical and hydraulic equipment.



fore it could run an aircraft factory. Working on their original order of 40 planes, they trained key groups of technicians from the Air Force and from private industry. The first Australian-built NA-33 made its appearance in May, 1939. Twenty-eight months later, there were 1,000 Australian-built warplanes in the air. The original order had been stepped up from 40 to 811.

Australia's need for aircraft was so great that the NA-33, originally an advanced trainer, was adapted as an all-purpose aircraft. Wackett built extra strength into the wings, and moved the bomb-rack outside the airscrew disc to enable the NA-33 to function as a workmanlike dive-bomber. He was enthusiastic about the way the sturdy basic design took to his modifications. It is this adaptation that the R.A.A.F. calls the "Wirraway," an Australian aboriginal word meaning "challenger." Today, hundreds of "Wirraways" are on operational duty at Australian defense bases.

"Wirraway" squadrons are also flying from operational bases in Malaya, which successive Australian prime ministers have described as "Australia's frontier in the Pacific."

Infant Industry Succeeds

All this was accomplished by an infant industry manned by machinists accustomed to work at tolerances of perhaps hundredths of an inch, who now had to work to thousandths.

It was in Australia's production of the Beaufort bomber (the torpedo bomber that starred at Matapan) that Wackett's canny choice paid off. The British Bristol Beaufort was powered by Bristol engines, and Australian plans had been laid to import the engines and build only the fuselage. Suddenly, early in 1941, Australia's A.P.C. (Aircraft Production Commission) headed by Harold W. Clapp, an engineer who had electrified railroads from New York to Berkeley, Calif., had to draft plans to build the engines too.

Designers modified the Beaufort to take Twin Wasp engines. Of 33,000 jigs, tools, and fixtures ordered from Britain, only 7,000 were ever delivered. There was no plant. Railway workshops in three state capitals more than 500 miles apart were tooled to make the aircraft in sections. A $4,000,000 engine factory was built in Sydney.

Meanwhile, the A.P.C. luckily obtained an order for Twin Wasps originally placed by the French, providing a backlog of engines while the engine factory got into production. While Wackett's Wirraways are being made almost entirely in one plant, the Beauforts today are beginning their production flow from four different plants, with nearly 60 sub-contractors supplying parts.

Nobody in the A.P.C. pretended that this was more than improvisation, but as an A.P.C. engineer recently expressed it, "If we had listened to the experts, we might have had a perfect production set-up—next year. Instead of that, we have the Beauforts."

It is this sort of enterprise in production that is bringing along the planes to equip the 60,000 men in the R.A.A.F., and the backlog of 140,000 volunteers waiting to enter the Commonwealth's 35 air schools.

Identified as the NA-33 general purpose type, the model shown above is the original North American design after which the Australian Wirraways have been patterned. Test flown in September, 1937, it was shipped to Melbourne shortly afterwards.

Wirraways in the air. Built by Commonwealth in its Fishermen's Bend factory, near Melbourne, the planes are piloted by Empire Air Scheme pilots, with gunners in the rear cockpits. This formation is in flight over Malaya, Empire stronghold in the Pacific.

Bi-Monthly Schedule Set For Company Magazine

Starting with this edition, North American *Skyline* will be published on a bi-monthly basis, instead of quarterly as in the past.

The magazine is now starting its third year, having first appeared in January, 1940, when 5,000 copies of a 17-page edition were distributed to employes at the Inglewood factory.

Since that time, its size has more than doubled, and circulation has multiplied many times.

PLANT SAFETY +

A "SEEING EYE" dog is a fine friend for a blind man, but the prospect of having such a companion in his unfortunate circumstances sends a shudder through a normal person. Man's greatest asset is the ability to see, and any precaution taken for the eyes is the finest kind of insurance.

To determine the cause of eye accidents at North American, three safety engineers conducted a three-month survey in the plant. As a result of their findings, 5,000 pieces of protective eye equipment have been ordered for the use of employes.

When the goggles and face shields arrive, notices will be placed in clock racks explaining the type of eye equipment required for specific jobs. It is mandatory that employes use the type of protection specified for their particular jobs. Failure to do so will constitute a violation of company regulations.

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In January of last year, 30 men were sufficient to carry on the plant safety program, but due to the rapid expansion of the factory, 85 men are now required. Fifty men are on guard against accidents during the day shift, while 35 serve at night. Department with the most committeemen is the machine shop, with five safety men on days, and three at night.

Safety men are appointed in all production departments by Safety Engineer Richard Wilkins. It is their job to check safety devices in their departments, report additional equipment needed, help foremen and supervisors enforce safety regulations, and report on all accidents requiring the attention of a physician. Once a week, Wilkins conducts classes for committee members, including safety movies and discussions for the improvement of the plant safety program.

Ten new members have been added to the committee since Nov. 1. They are J. A. Morovich (3), W. D. Hunt (3), L. C. Vetter (6), B. E. Gale (10), J. M. Bauldin (17), A. B. Coalter (18), F. J. Andrews (22), E. D. Harper (32), O. W. Eisenhood (33), and W. E. Joyce (38).

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Approximately 1,500 injury cases are treated every 24 hours in North American's well-equipped first aid department. Fourteen Navy-trained nurses give prompt attention to minor cases ranging from cuts and bruises to head colds and headaches.

More serious cases are referred to Dr. Paul H. Smitgen, Inglewood physician.

Work of the first aid station in the employment office is closely coordinated with employment procedure. Preliminary physical examinations are given applicants, who are later sent to Dr. Smitgen for final examination. Two medical stenographers are employed in the office to compile records and statistics relative to accident analyses. Accident statistics are recorded weekly by departments and a form letter is sent each foreman giving a complete breakdown of injuries in his department.

Included in the new personnel building will be a complete emergency hospital unit containing minor surgery, dispensary, and diathermy rooms, plus a two-bed recovery room. Dr. Clarence L. Lloyd, formerly resident physician at the Good Samaritan hospital at Los Angeles, has been appointed resident physician in charge. If necessary, an X-ray technician and physiotherapist will be added to the staff. A panel of leading Los Angeles County specialists will be available for consultation and treatment.

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This month marks the beginning of the fourth year of the annual Safety award contest. At the close of each year, the Safety committee meets to average the departmental safety scores for the previous 12-month period, and the department with the lowest number of accidents in proportion to man-hours worked receives the yearly Safety trophy as a permanent possession. Announcement of the 1941 winner is expected shortly.

Handicaps are assigned to departments according to their size and type of work, and those for 1942 will be based on 1941 figures. Penalties are assessed on the basis of lost man-hours due to accidents. Because men sometimes fail to report minor injuries to the first aid department, infection often results. To check this neglect, additional penalties will be given departments which fail to report all accidents promptly to the first aid department.

Newest addition to North American's fire department is the three and one-half ton truck shown below. Equipment on the new truck includes a centrifugal water pump, a 500-gallon tank, a portable flood and spot-lighting plant, and asbestos suits for firemen. Standing before the truck, left to right, are Tom Fox, Leslie Repscher, and Ralph Thaxter. Stephen Smith is in the driver's seat.

The Feminine Slant

By Grace Dunn

RECREATION along the line of sports has many feminine participants at the Dallas plant. Indoor and outdoor activities vie for honors, as the girls enjoy their after-office hours venturing into the realms of hunting, bowling, ice skating, swimming, riding, and other sports. Some are experts, others are just beginners, but all are having the fun of getting together in informal groups to relax and to become better acquainted.

A North American bowling team, composed of Betty Alfred, Mary Brockway, Vera Lynn, Marie Taylor, and Josephine McClain, is in the middle of its tournament with other Dallas women's teams, and we predict that they stand a good chance of developing into champions.

Ice skating has taken Dallas by storm, and the Wednesday night sessions are becoming more and more popular. Everyone gathers at the Ice Arena for a two-hour session, held exclusively for North American employes. Although not many Texans can boast of cutting a figure on ice, there are a number of blades who have brought their skill from California and the North.

It's quite baffling to the beginner to understand how any sport, so graceful and seemingly easy, can be so emphatically difficult! But with a little pluck and a great deal of determination, we have promised ourselves to turn out at least a couple of Sonja Henies from among our enthusiastic group of girls.

Another winter activity, the continuation of a favorite summer sport, is indoor swimming. A quick plunge is refreshing after a busy day (should I say "buoys one up"?). Mary Frances Morris, Helen Andrean, and Betsy Nichols are among those to be seen at the local club pools, diving in for a brisk swim.

At the plant itself, the girls enjoy the cold, invigorating air and the bright sunshine during the noon hour as they compete in pitching horse shoes. This is an old Western pastime which many find amusing.

Responding to the national emergency, many of the girls have been doing their part through such activities as learning first aid procedure from the Red Cross, knitting, and unofficially assisting the United Service Organizations.

Among those who had completed the Red Cross first aid course at the time of this writing were Grace Turner, "Wally" West, and Joilette Hunn. Knitting their brows over "slip a stitch" and "purl one," are Diana Voitaw, Dorothy McElhaney, Ruth Hudnall, and Mazie Rogers.

This brief sketch has skimmed lightly over what we are doing and what we hope to do. With the help of our new recreation director, Harry Faulkner, we are expecting our groups to expand and develop into full-fledged and well-organized clubs.

Martha Ann Latham, right, seeks consolation from Dorothy Douthit after an encounter with cockle burr during a target-shooting tramp. Dorothy, incidentally, is an excellent shot.

Swimming is definitely a favorite winter sport with these Dallas girls. On the edge, left to right, are Patsy Thompson, Lida May Denny, Gene Norman, and Mary Kay Cinkuemanie. In the water is Jayne Kingston.

On rainy and informal Saturdays, Lucille Lewter finds it comfortable as well as chic, in the Western mode, to wear her cowboy boots, sombrero, and suede bolero to work.

Sub-Contracting...

(From Page 9)

lend itself to outside fabrication if necessary.

The production department determines what proportion of the total job is to be sub-contracted. This is based on a study of the man-hour machinery load curve for the department concerned. All production requirements beyond the capacity of the department concerned must obviously be sub-contracted. Which specific parts are to be sub-contracted is then determined on the basis of tooling, nature of the work, and like considerations.

An outside production department maintains a continuing study of outside production facilities available, capacities of such plants, and ability of the various shops to handle the required work. Among the elements entering into this determination are suitability of machinery, ability to meet required delivery dates, ability to meet quality standards, and general considerations of business responsibility and reliability.

Maintain Personal Contact

All these factors are determined by a staff of field men who maintain constant personal contact with such plants. This staff has multiplied fifteen times in little more than a year. These men are specially trained for such work and often must educate small shops to the required standards. They frequently find themselves serving as advisers on varied problems of management, machine efficiency, material conservation, and shipping.

After placing of the contracts, the sub-contract work is supervised by a follow-up department which investigates production schedules to make certain that delivery is made within the required time. Inspection is handled by a separate outside inspection department, which, wherever possible, inspects the work before it is shipped from the sub-contractor's plant.

When this is not practicable, a separate inspection is performed at the time of receiving at the primary plant. The receiving department maintains a reporting system which keeps the follow-up and outside production departments informed at all times of the parts or materials placed in the stockroom.

Through the follow-up and production control departments, a constant check is maintained on location and progress of all parts and materials. This makes it possible to allocate parts and materials among the three plants, if necessary, and also to aid the individual sub-contractor when needed. Such aid may consist of furnishing extra material, helping the sub-contractor obtain priorities, furnishing machine tools, and supplying additional blueprints.

Follow-Up Collaborates

The central follow-up department also works in close collaboration with the outside production department to supply tips on prospective plants where work might be farmed out, or to advise against the use of certain shops which may already be overloaded. Follow-up men must have considerable experience and be carefully trained. It is preferred that such men have experience in the company's planning, material control, and production control departments.

They must also be well acquainted with the design, construction, and detailed parts of the three principal North American production models, the B-25 bomber, the P-51 pursuit, and the AT-6A advanced trainer. They must be aggressive enough to keep the wheels turning, and at the same time patient and tactful enough to avoid friction.

Investigators' Job Exacting

The job of the investigators who report on prospective sub-contractors is somewhat different, but no less exacting. Such investigators must know as much about shop equipment as a seasoned machinist. Preferred are men who have had experience in the shipping and receiving departments. They must know machinery, tools, jigs, and fixtures, and must be able to read blueprints. They must also have an intimate knowledge of the company's production models. As mentioned earlier, the number of men now active in conducting our sub-contracting program has grown tremendously. We are increasing this number steadily, but it cannot be done overnight, due to the special qualifications such men must possess.

The inspectors must also have special training and qualifications, and the same is true of the personnel in receiving and shipping. A complex cross-indexed bookkeeping system has been developed to keep all departments concerned informed of progress throughout the entire scope of the sub-contracting program.

It is a complex and difficult problem, but through teamwork of all concerned we believe we are performing the only production miracle possible at this time.

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Dr. Lloyd Appointed Resident Physician

Early in November, Dr. Clarence L. Lloyd was appointed full-time resident physician at the Inglewood plant to handle all emergency cases formerly sent outside for treatment.

A graduate of the Loyola School of Medicine at Chicago, Dr. Lloyd took his internship at the Cook County and St. Anne's hospitals in that city, and later served as house physician for the La Salle and Stevens hotels there.

In 1935, he moved to Los Angeles where he joined the staff of the County hospital, and later served four years as resident physician at the Good Samaritan hospital in that city.

Facilities are now being set up in the new employment unit west of the main factory building for a complete emergency hospital, with minor operating, X-ray, and diathermy rooms, and a two-bed recovery room.

North American Devises Own Version of Emblem

"To Keep 'Em Flying, Get 'Em Built."

So goes North American's version of the slogan adopted by the United States Army Air Forces to aid in its recruitment program. "Let's Go, U.S.A., Keep 'Em Flying," is the wording on the official Army emblem.

The three pursuit planes encircled by the lettering in the original design have been replaced in the North American adaptation by the traditional NAA emblem, complete with letters and eagle.

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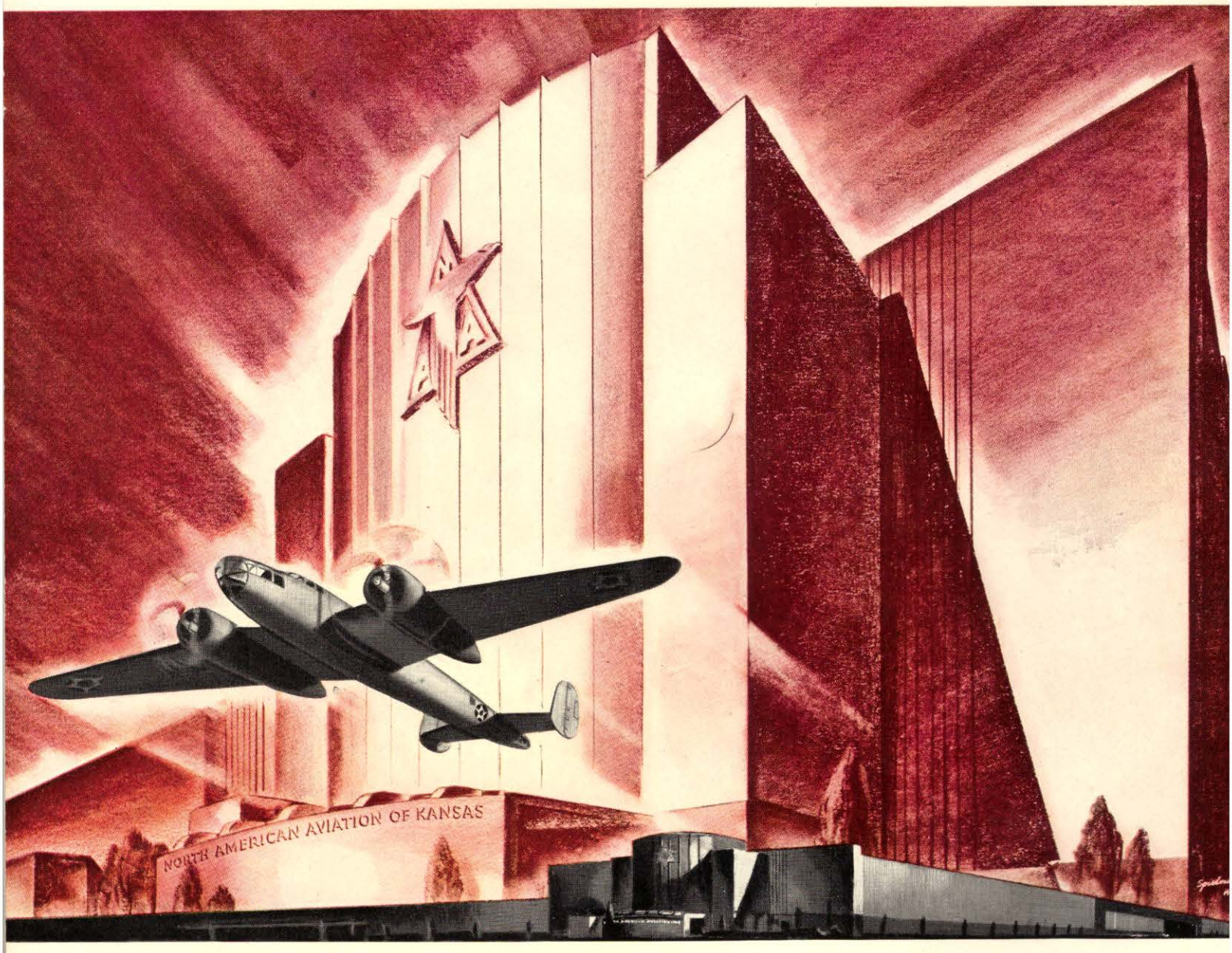

The North American Aviation and General Motors Corporation Production Team is First in the Emergency Bomber Program

THIS GREAT PLANT in the heart of America, designed by North American Aviation and built by the Corps of Engineers, U. S. Army, is your plant, dedicated to the defense of your home, your freedom and your way of life. Under North American management, and supported by the vast manufacturing resources of General Motors, it is now producing the North American B-25, the world's finest medium bomber. This achievement parallels the production record of North American's Dallas plant, the first complete manufacturing unit put in production under the emergency program.

THE NORTH AMERICAN WAY IS TO BUILD WITH Teamwork

NORTH AMERICAN AVIATION, INC.

DALLAS INGLEWOOD, CALIF. KANSAS CITY